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**PROVISIONAL SPECIFICATION**

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**Invention Title:**

A SUPPORT FOR SUPPORTING A STRUCTURE ON A SURFACE

The invention is described in the following statement:

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# A SUPPORT FOR SUPPORTING A STRUCTURE ON A SURFACE

## Field of the Invention

The present invention broadly relates to a support for supporting a structure on a surface and particularly, although not exclusively, to a support having at least one self-adjusting support element.

## Background of the Invention

Structures such as tables, ladders and tripods have legs for positioning on a surface. If not all of the legs contact the surface, the position of the structure will be unstable. The position of the structure can be made more stable by adjusting the heights of individual legs. This is often done with a screw-type mechanism commonly found at the bottom of the legs.

Alternatively, all of the legs may be in contact with the surface but the structure may not have a desired orientation relative to the surface. Again, the position of the structure relative to the surface may be adjusted by adjusting the height of the individual legs with the same type of screw mechanism. Other structures such as large machines and houses may contact the ground directly without legs or through supporting beams or a base plate. Level or tilt adjustment of these large structures typically is done with individually controlled jacks or wedges.

In any case the adjustment of the position of the structure typically is cumbersome and time consuming. There is a need for a technically advanced solution.

Pistons have been utilised to stabilise structures such as ladders, tripods and tables. Generally one piston is associated with each leg of the structure. The pistons

are in fluid communication. Thus the pistons can be utilised to together adjust the position of individual support legs. When the position of the structure is considered stable the pistons are manually isolated so no further adjustment occurs. These systems do not provide self-adjusting support.

## Summary of the Invention

The present invention provides in a first aspect a support for supporting a structure on a surface, the support comprising at least one support element, the or each support element comprising:

a piston,

a cylinder in which the piston is moveable, and

a braking means for maintaining the piston in a position that is stable relative to the cylinder,

wherein the piston and the cylinder are arranged so that a loading associated with the structure effects an adjustment of the support element,

and wherein an increase in hydraulic pressure within the cylinder effected by the loading associated with the structure activates the braking means.

The or each cylinder typically has a fluid inlet/outlet and typically is arranged so that an amount of fluid flowing through the inlet/outlet controls the movement of the or each piston relative to the or each cylinder. The or each cylinder typically has an opening positioned so that in use the movement of the or each piston effects a movement of a surface contact portion of the or each support element relative to the surface.

The structure typically has at least two support elements. In this case the fluid inlet/outlets typically

are interconnected by at least one fluid conduit so that the fluid can flow between the inlet/outlets. The support typically is arranged so that in use, when the support is placed on the surface and at least one of the surface contact portions does not contact the surface, a movement of the pistons relative to the cylinders is effected that adjusts the positions of the surface contact portions relative to the surface.

The support typically is self-adjusting which has a significant practical advantage. For example, the structure with support may be placed on the surface and at least one of the surface contact portion may contact the surface while at least one other contact portion may not contact the surface. The surface may be uneven or the structure may be placed on the surface in an angled position. The structure typically is arranged so that the or each piston associated with the surface contact portion that contacts the surface moves inwardly and typically pushes fluid into the or each cylinders associated with the or each other contact portion that does not contact the surface which typically effects movement of each contact portion.

Alternatively, all contact portions may contact the surface but the structure may be tilted to a side such as the rear of the structure. In this case the loading on the or each rear support element would increase and the loading on the or each front support element would decrease. The structure typically is arranged so that the or each piston associated with the increased loading moves inwardly and typically pushes fluid into the or each cylinders associated with the or each support element associated with the decreased loading.

The support typically is arranged so that, after adjustment and if all contact portions contact the surface, the loading on the support elements effects an increase in hydraulic pressure within the or each cylinder which actuates the braking means and inhibits movement of the pistons so that the structure is in an adjusted and stable position.

In one embodiment each piston comprises the surface contact portion arranged to contact the surface. Alternatively, the surface contact portion may be a component that is either in direct or indirect contact with the piston and that may be positioned so that a movement of the pistons relative to the cylinder effects a movement of the surface contact portions.

In a variation of this embodiment each cylinder may comprise a surface contact portion arranged to contact the surface. Alternatively, the surface contact portion may be a component that is either in direct or indirect contact with the cylinder and that may be positioned so that a movement of the cylinder relative to the pistons effects a movement of the surface contact portions.

In a specific embodiment the support is arranged so that the pistons move relative to the cylinders, until an increase of pressure in the cylinders actuates the braking means. For example, this may be the case when the pressure in all cylinders has the same level.

The braking means of each support element may be hydraulic. For example, the piston of each support element may have a cavity arranged so that in use fluid can penetrate from the inlet/outlet into the cylinder and into the cavity. In one specific embodiment of the present invention the piston is elongate and at least one side portion has at least one recess that is linked to the

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cavity. A brake-pad or brake-cylinder typically is positioned in the or each recess of the piston and arranged so that, if fluid penetrates into the cavity, the or each brake-pad or brake-cylinder is in use moved towards an interior wall of the cylinder. In this case the braking means typically is arranged so that an increase of the fluid pressure in the cavity increases the pressure of the or each brake-pad or brake-cylinder against the interior wall of the cylinder and thereby acts against the moveability of the piston in the cylinder.

In a variation of this embodiment the cylinder may have at least one recess in an interior side wall. The or each brake pad or brake cylinder may be positioned in the or each recess of the interior side wall and arranged to push against the piston.

The braking means of each support element may also be mechanical. For example, the support element may comprise a brake portion which typically is moveable relative to the cylinder and with the piston until the movement of the surface contact portion is restricted, for example by contact with the surface. For example, the brake portion may be the surface contact portion. In this case piston and brake portion may be arranged so that, when the movement of the brake portion is restricted, a further movement of the piston relative to the cylinder activates the braking means. For example, the braking means may be arranged so that a movement of the brake portion against an interior wall of the cylinder may be effected. In this case the piston and the braking means may have wedging portions which in use effect the movement of the brake portion against the interior wall of the cylinder. Further, the brake portion may have one or more teeth an exterior portion that are arranged to interlock with one

or more teeth on the interior wall of the cylinder if the brake portion is pushed against the interior wall of the cylinder.

In one embodiment of the present invention the support comprises a reservoir for the fluid that is interconnected with the fluid inlet/outlets and that is in use typically positioned above the cylinders. The cylinders, fluid inlet/outlets typically are connected so that a closed system in formed which may comprise the reservoir.

The support may also comprise a valve arranged to receive a hydraulic liquid. In this case the support typically is arranged so that, when the valve is opened and the hydraulic liquid is pumped into the support, the or each support element lift the structure from a first level to a second level.

For example, the structure may be a furniture item such as a table, building such as a house, or any other structure that may be placed on a surface. The structure typically has three or four support elements, but may alternatively have any number of support elements.

The present invention provides in a second aspect an adjustable support for supporting a structure on an underlying surface, the support comprising a piston cylinder assembly, the piston being moveable relative to the cylinder with one of the piston or cylinder being connected to, or forming part of, the structure and the other being associated with a contact portion operative to engage the underlying surface, and braking means for inhibiting movement of the piston relative to the cylinder, wherein the braking means is operative in

response to the application of predetermined loading conditions to a portion of the support.

The present invention provides in a third aspect a braking system for a piston and cylinder assembly, the braking system comprising a braking means adapted to be actuated by an increase in fluid pressure within the cylinder.

In one embodiment of the third aspect the piston has a cavity arranged so that in use fluid can penetrate from an inlet/outlet into the cylinder and into the cavity and wherein at least one side portion of the piston has at least one recess that is linked to the cavity. In this embodiment a brake-pad or brake-cylinder is positioned in the or each recess of the piston and arranged so that if fluid penetrates into the cavity the or each brake-pad or brake-cylinder is in use moved towards an interior wall of the cylinder and the braking means is arranged so that an increase of the fluid pressure in the cavity increases the pressure of the or each brake-pad or brake-cylinder against the interior wall of the cylinder and thereby acts against the moveability of the piston in the cylinder.

In a second embodiment of the third aspect the braking system includes a cavity separating a piston plate from the piston. The cavity contains resistance means such that in use the piston plate and piston are retained in a distal position relative to one another and on an increase in fluid pressure within the cylinder the piston plate and piston move proximal to one another. The cavity further contains at least one inlet/outlet extension extending through at least a portion of the cavity so that in use

fluid can penetrate from an inlet/outlet into the inlet/outlet extension and into the cylinder, and means for disrupting penetration of fluid through the inlet/outlet extension and into the cylinder upon an increase in fluid pressure within the cylinder.

In one form the resistance means comprises a spring or fluid-filled bladder.

In one form the inlet/outlet extension comprises a tube extending through the cavity and into the cylinder.

In one form the tube is flexible and at least one of the piston plate and piston comprises crimpers extending into the cavity such that when the fluid pressure in the cylinder increases and the piston plate and piston move proximal to one another the crimpers compress the flexible tube and disrupt fluid flow into the cylinder.

In another form the tube includes a valve such that when the fluid pressure in the cylinder increases and the piston plate and piston move proximal to one another the valve disrupts fluid flow through the tube and into the cylinder.

In one form the tube includes a first member extending therethrough and the cavity contains a second member, the first member including a flow aperture to allow fluid penetration through the tube, the second member being adapted to move between an open position and a closed position such that in the closed position the flow aperture is blocked by the second member, disrupting fluid penetration through the tube and into the cylinder.

In one form the inlet/outlet extension comprises a helical flexible tube portion extending through at least a portion of the cylinder.

In a fourth aspect, the present invention provides a support for supporting a structure on a surface, the support comprising at least one support element, the or each support element comprising a piston, a cylinder in which the piston is moveable, and a braking means for maintaining the piston in a position that is stable relative to the cylinder, wherein the piston and the cylinder are arranged so that a loading associated with the structure effects an adjustment of the support element, and wherein the loading associated with the structure activates the braking means if the moveability of a surface contact portion of the support element is reduced below a threshold value.

Brief Description of the Drawings

Figures 1A and 1B show schematic representations of a support for a structure according to an embodiment of the present invention,

Figure 2 shows a schematic representation of a support element for supporting a structure according to an embodiment of the present invention,

Figure 3 shows a schematic representation of a support element for supporting a structure according to another embodiment of the present invention,

Figure 4 shows a schematic representation of a support element for supporting a structure according to a further embodiment of the present invention,

Figure 5 shows a schematic representation of a support element for supporting a structure according to yet another embodiment of the present invention,

Figure 6 shows a perspective view of a representation of a support for a structure according to an embodiment of the present invention,

Figure 7 shows a side elevation view of a representation of the support for a structure of Figure 6,

Figure 8 shows a bottom perspective view of a representation of the support for a structure of Figure 6,

Figure 9 shows a front perspective view of a representation of the support for a structure of Figure 6,

Figure 10A and 10B show a schematic representation of a support for a structure according to an embodiment of the present invention,

Figure 11 shows a schematic representation of the support for a structure of Figures 10A and 10B in use,

Figure 12 shows a schematic representation of a support element for supporting a structure according to an embodiment of the present invention,

Figure 13 shows a schematic representation of the support element for supporting a structure of Figure 12,

Figure 14 shows a schematic representation of the support element for supporting a structure of Figure 12,

Figure 15 shows a schematic representation of the support element for supporting a structure of Figure 12,

Figure 16 shows a schematic representation of the braking means of the support element for supporting a structure of Figure 12,

Figure 17 shows a schematic representation of a support element for supporting a structure according to an embodiment of the present invention,

Figures 18A and 18B shows a schematic representation

of a support element for supporting a structure according to an embodiment of the present invention,

Figure 19 shows a schematic representation of a support element for supporting a structure according to an embodiment of the present invention,

Figure 20 shows a schematic representation of a ball valve of the support element for supporting a structure of Figure 19,

Figure 21 shows a schematic representation of a support element for supporting a structure according to an embodiment of the present invention, and

Figure 22 shows a schematic representation of a support element for supporting a structure according to an embodiment of the present invention.

## Detailed Description of Specific Embodiments

Referring initially to Figures 1A and 1B, a support for a structure according to an embodiment of the present invention is now described. Figure 1A shows the support 10 supporting a structure 16. The support comprises in this embodiment 3 or 4 support elements and Figure 1A only shows two of the support elements. Each support element 12 and 14 comprises a cylinder 18 and a piston 20. The cylinders 18 have fluid inlet/outlets 22 which are connected by pipe 24. The cylinders are filled with a fluid so that the amount of the fluid that flows through the inlet/outlets 22 determines the movement of the pistons 20 in the cylinders 18. As the fluid inlet/outlets are interconnected, an upward movement of one of the pistons in the respective cylinder effects a downward movement of the other cylinder.

The support is placed on surface 26 and the weight of

the structure effects an upward movement of piston 20 in support element 14 and a downward movement of piston 20 in support element 12. The movements of the pistons therefore adjust the support elements 12 and 14. Once both pistons have reached the adjustment positions, the loading associated with the structure 16 effects a pressure increase within the cylinders and a brake (not shown) secures the pistons in the cylinders in the stationary position. As in this embodiment the adjustment and the securing of the pistons in the cylinders happens automatically, the support is self-adjusting.

The support 10 can also be used for a level adjustment. For example, the structure 16 may be a refrigerator supported by four support elements such as support element 12 and 14. If the refrigerator is tilted backwards, the pistons of the rear support elements move upwards and push hydraulic liquid into the cylinders of the front support elements and the pistons of the front support elements move in a downward direction. Once the refrigerator is released, the refrigerator will stay in the adjusted position and the weight of the refrigerator will effect brakes of each support element to engage the respective piston with the respective cylinder.

In this embodiment, the support 10 also includes a valve 25 arranged to receive a hydraulic liquid. When the valve 25 is open and the hydraulic liquid is pumped into the support 10, the pistons 20 of all support elements move in a downward direction relative to the cylinders 18 and thereby lift the structure 16.

Figure 1B shows a variation of the embodiment shown in Figure 1A. In this case the structure that is supported by the support 26 is a table 26.

Figure 2 shows a support element 30 for supporting

the structure, such as support element 12 or 14, in more detail. The support element 30 comprises a cylinder 32 in which a piston 34 is guided. The cylinder 32 has a fluid inlet/outlet opening 36 for receiving and ejecting fluid 38, such as a hydraulic liquid or water. The piston 34 has a seal 35 for sealing the fluid 38 in the cylinder 32. The fluid inlet/outlet 36 is connected to another such fluid inlet/outlet of another support element (not shown). In this embodiment the piston 34 has a cavity 40 having openings 42 and 44 at the side portions of the piston 34. In the openings 42 and 44 brake cylinders 46 and 48 are guided and if the fluid pressure in the cylinder 32 is above a threshold level, the brake cylinders 46 and 48 are pushed against the interior wall of the cylinder 32 so as to position the piston 34 in a stationary position relative the cylinder 32. The cylinder 32 also has a thread 33 for mounting on a structure.

Typically, a structure such as a table is supported by 3 or 4 of the support elements 30 which are interconnected. After placing the table on a surface, the support elements typically adjust for an uneven surface and fluid will flow between the cylinders until the pistons are in the adjustment position. The weight of the structure will increase the pressure above the threshold pressure and the brake cylinders 46 and 48 move against the interior wall of the cylinder 32 so as to position the pistons stationary. Consequently, the table will then have a stable position.

Figure 3 shows a support element 50 for supporting a structure according to another embodiment of the invention. Again, the support element 50 may function as support element 12 or 14 in the embodiment shown in Figures 1A and 1B and described above. The support

element 50 comprises a cylinder 52 in which a piston 54 is guided. The cylinder 52 has a fluid inlet/outlet opening 56 for receiving and ejecting fluid 58, such as a hydraulic liquid or water. The piston 54 has a seal 55 for sealing the fluid in the cylinder 52. The fluid inlet/outlet 56 is connected to another such fluid inlet/outlet of another support element (not shown). In this embodiment the support element 50 comprises another piston 60 positioned below the piston 54. The piston 54 has a cylindrical projection 62 which is received by a corresponding cylindrical bore 66 of the piston 60. The piston 60 has a cavity 68 which is filled with a hydraulic fluid 58 and which has openings 70 and 72. Brake cylinders 74 and 76 are guided in the openings 70 and 72 and, if the fluid pressure in the cavity 68 is above a threshold level, the brake cylinders 74 and 76 are pushed against the interior wall of the cylinder 52 so as to position the piston 60, and thereby the piston 54, in a stationary position relative the cylinder 52. The fluid pressure in the cavity 68 increases in response to the loading associated with the structure. That is, if the moveability of a surface contact portion 102 of the support element 50 is reduced below a threshold value by the loading associated with the structure.

The cylinder 32 also has a thread 77 for mounting on a structure.

Further, the support element 50 comprises a compression spring 79 positioned around the projection 62. When the structure is lifted and therefore the loading on the support element is reduced, the spring 79 functions to push the pistons 54 and 60 apart from one another and thereby reduces the pressure of the fluid in the cavity 68. As a consequence, a back-movement of the brake

cylinders 74 and 76 is supported.

Figure 4 shows a support element 80 for supporting a structure according to a further embodiment of the invention. Again, the support element 80 may function as support element 12 or 14 in the embodiment shown in Figures 1A and 1B and described above. The support element 80 comprises a cylinder 82 in which a piston 84 is guided. The cylinder 82 has a fluid inlet/outlet opening 86 for receiving and ejecting fluid 88, such as a hydraulic liquid or water. The piston 84 has seals 85 for sealing the fluid in the cylinder 82. The fluid inlet/outlet 86 is connected to another such fluid inlet/outlet of another support element (not shown). In this embodiment the support element 80 comprises another piston 90 positioned below the piston 84. The piston 84 has a cylindrical projection 92 which is positioned in a recess 96 of the piston 90.

The piston 90 has a ring-portion 98 which is composed of an elastic material such as a rubber-like material and the projection 92 of the piston 84 has a wedge portion 100. In this embodiment the piston 90 has a surface contact portion 102 and when the support element 80 is in an adjusted position after movement of the piston 84 relative to the cylinder 82, the surface contact portion contacts the surface and the movement of the piston 90 is restricted. The weight of the structure effects a further movement of the piston 84 in a downward direction against the piston 90 and the wedge portion 100 wedges the elastic ring-like portion 98 outwardly against the interior wall of the cylinder 82 and thereby inhibits further movement of the pistons 90 and 84 in the cylinder 82.

Figure 5 shows a support element 110 for supporting a structure according to a yet another embodiment of the

invention. Again, the support element 110 may function as support element 12 or 14 in the embodiment shown in Figures 1A and 1B and described above. The support element 110 comprises a cylinder 122 in which a piston 114 is guided. The cylinder 112 has a fluid inlet/outlet opening (not shown) for receiving and ejecting fluid 118, such as a hydraulic liquid or water. The piston 114 has a seal 115 for sealing the fluid in the cylinder 112. The fluid inlet/outlet is connected to another such fluid inlet/outlet of another support element (not shown). In this embodiment the support element 110 comprises a surface contact portion 120 which is positioned below the piston 114 and around projection 122 of the piston 114.

The projection 122 has wedge-shaped side projections 124 and the surface contact portion 120 has wedge-shaped recesses 126. In this embodiment, the surface contact portion comprises two parts 120 a and 120 b. When the support element 110 is in an adjusted potion after movement of the piston 114 relative to the cylinder 112, the surface contact portion 120 contacts the surface and the movement of the surface contact portion therefore is restricted. The weight of the structure effects a further movement of the piston 114 in a downward direction against the surface contact portion 120 and the wedge portions 122 move parts 120 A and 120b apart from one another and towards the interior wall of the cylinder 112. In this embodiment, the lower part of the interior wall of the cylinder 112 has at least one tooth 128 on the surface and the parts 120 A and 120 B have toothed surfaces 130. When the parts 120 A and 120 B are moved towards the interior side wall of the cylinder 112, the teeth 128 engage with the toothed surface 130 and the engagement inhibits further movement of the piston 118 and the surface contact

portion 120.

Figures 6 – 9 show two support elements 140 and 140' in use in a table 141. The support elements 140 and 140' comprise a cylinder 132 and 132' in which a piston 134 and 134' is guided. The cylinders 132 and 132' have a fluid inlet/outlet opening 136 and 136'. The fluid inlet/outlet openings 136 and 136' are in fluid communication with one another by means of channel 137. In this embodiment the support elements 140 and 140' comprise a piston extension 144 and 144' which is positioned below the pistons 134 and 134' and attached thereto. The piston extensions 144 and 144' are guided in telescopic cylinders 142 and 142'.

In use the table 141 is placed on an uneven surface and the support elements 140 and 140' typically adjust for the uneven surface. The fluid 138 will flow between the cylinders 132 and 132' until the loading associated with the structure acts to increase the fluid pressure within the cylinders 132 and 132' above a threshold pressure and the braking means 135 act to retain the piston 134 and 134' in a stationary position relative to the cylinder 132 and 132'. Consequently, the table 141 will then have a stable position.

Figures 10A, 10B and 11 show a support element 150 for supporting a structure according to a yet another embodiment of the invention. Again, the support element 150 may function as support element 12 or 14 in the embodiment shown in Figures 1A and 1B and described above. The support element 150 comprises a cylinder 152 in which a piston 154 is guided. The piston 154 includes a seal 155 which stops the fluid 158 from escaping the cylinder 152. The cylinder 152 has a fluid inlet/outlet opening 156. The fluid inlet/outlet opening 156 is in fluid communication with another such fluid inlet/outlet opening 156'. In this

embodiment the support element 150 comprises a piston extension 160 which is positioned below the piston 154 and attached thereto. The piston extension 160 is guided in telescopic cylinder 162. This piston extension 160 and telescopic cylinder 162 combination protects the piston 154 and cylinder 152 assembly of support element 150. It can be seen that in use the transverse load on the piston 154 and cylinder 152 assembly is limited by the protective piston extension 160 and telescopic cylinder 162 combination.

In use the piston extension 160 and telescopic cylinder 162 allow the support element 150 to be composed of lighter-weight materials with less strength than would be required without the piston extension 160 and telescopic cylinder 162.

Figure 11 shows two support elements 150 and 150' incorporated into a table 161. The support elements 150 and 150' are in fluid communication by means of fluid channel 163.

In the embodiment discussed above the cylinder and pistons are composed of a metallic material such as aluminium or steel. Alternatively, the pistons and cylinders may also be composed of a suitable plastics material. The inlet/outlets of the support elements typically are interconnected using a suitable rubber hose, but may also be interconnected using a plastics or metallic hose. The internal diameter of the hose and also additional valves may be used to control the throughput of the hydraulic liquid through the hose and therefore the sensitivity (reaction speed) of the support for adjusting for changed loading conditions. The inlet/outlets may also be interconnected via a reservoir.

Figures 12 - 15 show a support element 170 for

supporting a structure in more detail. The support element 170 comprises a cylinder 172 in which a piston 174 is guided. The cylinder 172 has a fluid inlet/outlet opening 176 for receiving and ejecting fluid 178, such as a hydraulic liquid or water. The fluid 178 is contained in a bladder 179. The fluid inlet/outlet 176 is connected to another such fluid inlet/outlet of another support element (not shown). In this embodiment the piston 174 has a cavity 180 having openings 182 and 184 at the side portions of the piston 184. Cavity 180 contains fluid 181, such as hydraulic fluid or water. In the openings 182 and 184 brake cylinders 186 and 188 are guided and if the fluid pressure in the cylinder 172 is above a threshold level, the brake cylinders 186 and 188 are pushed against the interior wall of the cylinder 172 so as to position the piston 174 in a stationary position relative the cylinder 172. The cavity 180 further includes seals 189 for retaining fluid 181 within the cavity 180. The cylinder 172 also has a thread 173 for mounting on a structure. In the embodiment shown in figure 14 the cavity fluid 181 is maintained in a bladder 183.

Further, in the embodiment shown in figures 12 - 15 a piston plate 194 is positioned between the fluid 178 in the cylinder 172 and the piston 174. The piston plate 194 includes a piston plate guide 195 which extends into the cavity 180. Seals 197 are positioned to retain fluid 181 in cavity 180

If the fluid pressure in the cylinder 172 is above a threshold level the pressure is transferred through the fluid 181 in the cavity 180 into the brake cylinders 186 and 188 such that the brake cylinders 186 and 188 are forced against the interior wall of the cylinder 172. At a threshold level the piston 174 is held in a fixed position

in relation to the cylinder 172.

The distance between the brake cylinders 186 and 188 and the fluid 178 in the cylinder 172 is minimised in order to reduce the overall length of the support element 170.

Figure 16 shows detail of the piston 174 and brake cylinders 186 and 188 of Figures 12 - 15. Brake cylinders 186 and 188 comprise a brake arm 190 and brake pad 192. The brake arm 190 is attached to the piston plate 194 and piston plate guide 195 by means of a brake arm cradle 196 at a connection point 197.

Figure 17 shows detail of a support element 200 for supporting a structure in a further embodiment of the invention. The support element 200 comprises a cylinder 202 in which a piston 204 is guided. The cylinder 202 has a fluid inlet/outlet opening 206 for receiving and ejecting fluid 208, such as a hydraulic liquid or water. The fluid inlet/outlet 206 is connected to another such fluid inlet/outlet of another support element (not shown). The fluid inlet/outlet opening 206 includes a fluid inlet/outlet extension 207 which extends through a fluid chamber 209 of the cylinder 202.

In this embodiment the support element 200 has a cavity 210 positioned between a piston plate 214 and piston 204. The cavity 210 has an opening 211 extending into the piston 204. Piston plate 214 abuts fluid chamber 209 and comprises a piston plate guide 216 which extends into opening 211 in piston 204. Piston plate 214 further comprises crimpers 218.

The fluid inlet/outlet extension 207 extends into the cavity 210 and to the fluid inlet outlet 206 such that the fluid enters the fluid chamber 209 after proceeding through the cavity 210 within the fluid inlet/outlet

extension 207. Fluid inlet/outlet extension 207 includes a flexible portion 208 which extends through the cavity 210.

The cavity 10 further includes a resistance means 212. Resistance means 212 retains the piston plate 214 in a position distal from the piston 204. An increase in fluid pressure within the fluid chamber 209 acts against resistance means 212 to move the piston plate 214 proximal to the piston 204. It can be seen that this movement brings the crimpers 218 into contact with the flexible portion 208. In use, this disrupts the flow of fluid through fluid inlet/outlet extension 207 and inlet/outlet 206 into fluid chamber 209.

If the fluid pressure in the cylinder 202 and fluid chamber 209 is above a threshold level this disruption of flow results in the braking of the piston 204 such that the piston 204 is held in a fixed position in relation to the cylinder 202.

Figures 18 - 20 show detail of a support element 220 for supporting a structure in a further embodiment of the invention. The support element 220 comprises a cylinder 222 in which a piston 224 is guided. The cylinder 222 has a fluid inlet/outlet opening 226 for receiving and ejecting fluid 228, such as a hydraulic liquid or water. The fluid inlet/outlet 226 is connected to another such fluid inlet/outlet of another support element (not shown). The fluid inlet/outlet opening 226 includes a fluid inlet/outlet extension 227 which extends through a fluid chamber 229 of the cylinder 222.

In this embodiment the support element 220 has a cavity 230 positioned between a piston plate 234 and piston 224. Piston plate 234 abuts fluid chamber 229.

The fluid inlet/outlet extension 227 extends into the cavity 230 and to the fluid inlet/outlet 226 such that the

fluid 228 enters the fluid chamber 229 after proceeding through the cavity 220 within the fluid inlet/outlet extension 227.

The fluid inlet/outlet extension 227 includes a braking valve 236 which is moveable between a closed position and an open position. In the open position fluid 228 flows through the fluid inlet/outlet extension 227 and inlet/outlet 226. In the closed position fluid inlet/outlet extension 227 is closed disrupting the flow of fluid within the system.

The cavity 230 further includes a resistance means 232. Resistance means 232 retains the piston plate 234 in a position distal from the piston 224. An increase in fluid pressure within the fluid chamber 229 acts against resistance means 232 to move the piston plate 234 proximal to the piston 224. This movement actuates the valve 236 to bring it into a closed position.

The closed valve 236 results in the braking of the piston 224 such that the piston 224 is held in a fixed position in relation to the cylinder 222.

In the embodiment of Figure 19 the piston plate 234 includes a piston plate guide 235 which extends into a piston cavity 237 in the piston 224.

The braking valve 236 is a piston valve or ball valve.

Figure 20 shows a detailed view of a ball valve 236 within support element 220. Ball valve 236 somprises valve arm 238 which extends into cavity 230. When fluid pressure in the cylinder 222 increases piston plate 234 moves proximal to piston 224 actuating valve arm 238 to move. At a threshold pressure ball valve 236 closes inlet/outlet extension 227.

Figure 21 shows detail of a support element 240 for

supporting a structure in a further embodiment of the invention. The support element 240 comprises a cylinder 242 in which a piston 244 is guided. The cylinder 242 has a fluid inlet/outlet opening 246 for receiving and ejecting fluid 248, such as a hydraulic liquid or water. The fluid 248 is contained in a bladder 249. The fluid inlet/outlet 246 is connected to another such fluid inlet/outlet of another support element (not shown). The fluid inlet/outlet opening 246 includes a fluid inlet/outlet extension 247 which extends through the bladder 249.

In this embodiment the support element 240 has a cavity 250 positioned between a piston plate 254 and piston 244. Piston plate 254 abuts bladder 249.

The fluid inlet/outlet extension 247 extends into the cavity 250 and to the fluid inlet/outlet 246 such that the fluid 248 enters the bladder 249 after proceeding through the cavity 250 within the fluid inlet/outlet extension 247.

The fluid inlet/outlet extension 247 includes a breaking member 256 which is moveable between a closed position and an open position. In the open position fluid 248 flows through the fluid inlet/outlet extension 247 and inlet/outlet 246. In the closed position fluid inlet/outlet extension 247 is closed disrupting the flow of fluid 248 within the system. The breaking member 256 comprises a first ceramic disk 257 and a second ceramic disk 258. The first ceramic disk 257 includes an aperture 259 which allows the flow of fluid 248 through inlet/outlet extension 247.

The cavity 250 further includes a resistance bladder 252. Resistance bladder 252 is air or fluid-filled and retains the piston plate 254 in a position distal from the

piston 244. An increase in fluid pressure within the fluid chamber 249 acts against resistance means 252 to move the piston plate 254 proximal to the piston 244. This movement moves the second ceramic disk 258 such that it covers the aperture 259 disrupting fluid flow through inlet/outlet extension 247. This results in the braking of the piston 244 such that the piston 244 is held in a fixed position in relation to the cylinder 242.

Figure 22 shows a lever braking means 300 in a support element. The support element 290 comprises a cylinder 292 in which a piston 294 is guided. The cylinder 292 has a fluid inlet/outlet opening 296 for receiving and ejecting fluid 298, such as a hydraulic liquid or water. The fluid 298 is contained in a bladder 299. The fluid inlet/outlet 296 is connected to another such fluid inlet/outlet of another support element (not shown).

The braking means 300 comprises a braking arm 306 which is attached to piston guide 305 and thereby indirectly to piston plate 304. When the fluid pressure in the cylinder 292 reaches a threshold value the piston plate 304 moves downwardly actuating braking arm 306. Braking arm 306 comes into contact with the internal wall of cylinder 292. Contact between braking arm 306 and the internal surface of cylinder 292 retains piston 294 in a stationary position relative to cylinder 292.

The support can utilised in a variety of fields. For example, the support system can support a building, portable building, scaffolding, tripod, ladder, white goods, tables, chairs, furniture, stands, viewing platforms, machinery, bulldozers and construction equipment.

Figures 23 and 24 show a support element 260 incorporated into a helicopter landing structure 270. The

helicopter landing structure 270 comprises two or more independent landing struts 272. Each landing strut 272 incorporates one or more support elements 260. In the case where one landing strut 272 incorporates more than one support element 260, the landing strut may be divided such that in use there are four or more independent landing elements.

The support element 260 comprises a cylinder 262 in which a piston 264 is guided. The piston 264 is attached to the helicopter landing strut 272 such that movement of the landing structure 272 correlates with movement of the piston 264. The cylinder 262 has a fluid inlet/outlet opening 266 for receiving and ejecting fluid 268, such as a hydraulic liquid or water. The fluid 268 is contained in a bladder 269. The fluid inlet/outlet 266 is connected to another such fluid inlet/outlet of another support element (not shown).

The support element 260 further comprises braking means 274.

In use, upon the helicopter (not illustrated) landing on an uneven surface, the support element 260 typically adjusts for the surface and fluid 268 will flow between the cylinder 262 and the cylinder of another support element (not shown) associated with a separate landing strut (not shown). The fluid 268 will flow until the loading associated with the structure acts to increase the fluid pressure within the cylinder 262 above a threshold pressure and the braking means 274 act to retain the piston 264 in a stationary position relative to the cylinder 262. Consequently, the helicopter landing structure 270 will then have a stable position. This increases the safety of helicopter landings.

Although the invention has been described with

reference to particular examples, it will be appreciated by those skilled in the art that the invention may be embodied in many other forms. For example, the cylinder of each support element may comprise braking means that has parts which move against a side portion of the piston. Further, the cylinder of each support element may comprise a surface contact portion and the piston may be arranged to be connected to the structure. In addition, it is to be appreciated that the pistons and cylinders may be composed of any suitable material and may be of any suitable shape.

Further, the support may only comprise one support element. For example, the support may be a single supporting member, such as a prop for supporting a building structure, which is compressible and has a braking means which engage above a predetermined loading so that the supporting member can support the structure.

The Claims defining the Invention are as Follows:

1. A support for supporting a structure on a surface, the support comprising at least one support element, the or each support element comprising:

a piston,

a cylinder in which the piston is moveable, and

a braking means for maintaining the piston in a position that is stable relative to the cylinder,

wherein the piston and the cylinder are arranged so that a loading associated with the structure effects an adjustment of the support element,

and wherein an increase in hydraulic pressure within the cylinder, effected by the loading associated with the structure, activates the braking means.

2. The support as claimed in claim 1 wherein the cylinder has a fluid inlet/outlet and is arranged so that an amount of fluid flowing through the or each inlet/outlet controls the movement of the or each piston relative to the or each cylinder.

3. The support as claimed in claim 2 wherein the or each cylinder has an opening positioned so that in use the movement of the or each piston effects a movement of a *surface contact portion* of the or each support element relative to the surface.

4. The support as claimed in claim 3 comprising at least two support elements each of the support elements having a surface contact portion and wherein the fluid inlet/outlets are interconnected by at least one fluid

conduit so that the fluid can flow between the inlet/outlets.

5. The support as claimed in claim 4 being arranged so that in use, when the support is placed on the surface and at least one of the surface contact portions does not contact the surface, a movement of the pistons relative to the cylinders is effected that adjusts the positions of the surface contact portions relative to the surface.

6. The support as claimed in claim 5 wherein each piston comprises the surface contact portion arranged to contact the surface.

7. The support as claimed in claim 5 wherein the surface contact portion is a component that is either in direct or indirect contact with the piston.

8. The support as claimed in any one of claims 5 to 7 being arranged so that the pistons move relative to the cylinders, until an increase of fluid pressure in the cylinders actuates the braking means.

9. The support as claimed in any one of claims 5 to 7 wherein the braking means of each support element is hydraulic.

10. The support of claim 9 wherein the piston of each support element has a cavity arranged so that in use fluid can penetrate from the inlet/outlet into the cylinder and into the cavity.

11. The support as claimed in claim 10 wherein the piston of each support element is elongate and at least one side portion has at least one recess that is linked to the cavity.

12. The support as claimed in claim 11 wherein a brake-pad or brake-cylinder is positioned in the or each recess of the piston and arranged so that if fluid penetrates into the cavity the or each brake-pad or brake-cylinder is in use moved towards an interior wall of the cylinder.

13. The support as claimed in claim 12 wherein the braking means is arranged so that an increase of the fluid pressure in the cavity increases the pressure of the or each brake-pad or brake-cylinder against the interior wall of the cylinder and thereby acts against the moveability of the piston in the cylinder.

14. The support as claimed in claim 9 wherein the cylinder has at least one recess in an interior side wall and at least brake pad or brake cylinder is positioned in the or each recess of the interior side wall and arranged to push against the piston.

15. The support as claimed in any one of claims 5 to 8 wherein the braking means of each support element is mechanical.

16. The support as claimed in claim 15 comprising a brake potion which is moveable relative to the cylinder and with the piston until the movement of the surface contact portion is restricted.

17. The support as claimed in claim 15 wherein the brake portion is arranged so that, when the movement of the brake portion is restricted, a further movement of the piston relative to the cylinder activates the braking means.

18. The support of claim 17 wherein the braking means has wedging portions which in use effect a movement of the brake portion against an interior wall of the cylinder.

19. The structure as claimed in any one of the preceding claims having three support elements.

20. The structure as claimed in any one of claims 1 to 18 having four support elements.

21. The structure as claimed in any one of the preceding claims wherein the structure is a furniture item.

22. The structure as claimed in any one of the preceding claims wherein the structure is a table.

23. An adjustable support for supporting a structure on an underlying surface, the support comprising a piston cylinder assembly, the piston being moveable relative to the cylinder with one of the piston or cylinder being connected to, or forming part of, the structure and the other being associated with a contact portion operative to engage the underlying surface, and braking means for inhibiting movement of the piston relative to the cylinder, wherein the braking means is operative in response to the application of *predetermined loading conditions* to a portion of the support.

24. An adjustable support according to claim 1 wherein the braking means is operative in response to a threshold loading being applied to that portion of the piston cylinder assembly that is associated with the contact portion.

25. A braking system for a piston and cylinder assembly, the braking system comprising a braking means adapted to be actuated by an increase in fluid pressure within the cylinder.

26. A braking system as defined in claim 25, wherein the piston has a cavity arranged so that in use fluid can penetrate from an inlet/outlet into the cylinder and into the cavity and wherein at least one side portion of the piston has at least one recess that is linked to the cavity.

27. A braking system as defined in claim 26, wherein a brake-pad or brake-cylinder is positioned in the or each recess of the piston and arranged so that if fluid penetrates into the cavity the or each brake-pad or brake-cylinder is in use moved towards an interior wall of the cylinder.

28. A braking system as defined in claim 27, wherein the braking means is arranged so that an increase of the fluid pressure in the cavity increases the pressure of the or each brake-pad or brake-cylinder against the interior wall of the cylinder and thereby acts against the moveability of the piston in the cylinder.

29. A braking system as defined in claim 25, further including a fluid chamber within the cylinder, a piston plate positioned between the piston and the fluid chamber, and a cavity between the piston and the piston plate, the cavity containing:

resistance means such that in use the piston and piston plate are retained in a distal position relative to one another and on an increase in fluid pressure within the fluid chamber the piston and piston plate move proximal to one another;

at least one inlet/outlet extension extending through at least a portion of the cavity so that in use fluid can flow through the inlet/outlet extension and into the cylinder;

means for disrupting the flow of fluid through the inlet/outlet extension and into the cylinder upon an increase in fluid pressure within the cylinder.

30. A braking system as defined in claim 29, wherein the resistance means comprises a spring.

31. A braking system as defined in claim 29, wherein the resistance means comprises a fluid-filled bladder.

32. A braking system as defined in any one of claims 29 to 31, wherein the inlet/outlet extension comprises a tube extending through the cavity and into the cylinder.

33. A braking system as defined in claim 32, wherein the tube is flexible and at least one of the piston plate and piston comprises crimpers extending into the cavity such that when the fluid pressure in the cylinder increases and the piston plate and piston move proximal to one another

the crimpers compress the flexible tube and disrupt fluid flow into the cylinder.

34. A braking system as defined in claim 32, wherein the tube includes a valve such that when the fluid pressure in the cylinder increases and the piston plate and piston move proximal to one another the valve disrupts fluid flow through the tube and into the cylinder.

35. A braking system as defined in claim 34, wherein the valve is a ball valve.

36. A braking system as defined in claim 32, wherein the tube includes a first member extending therethrough and the cavity contains a second member, the first member including a flow aperture to allow fluid penetration through the tube, the second member being adapted to move between an open position and a closed position such that in the closed position the flow aperture is blocked by the second member, disrupting fluid penetration through the tube and into the cylinder.

37. A braking system as defined in claim 36, wherein the first member and second member are each ceramic disks.

38. A braking system as defined in any of claims 29 to 37, wherein the inlet/outlet extension comprises a helical flexible tube portion extending through at least a portion of the cylinder.

39. A support for supporting a structure on a surface, the support comprising at least one support element, the or each support element comprising:

a piston,

a cylinder in which the piston is moveable, and

a braking means for maintaining the piston in a position that is stable relative to the cylinder,

wherein the piston and the cylinder are arranged so that a loading associated with the structure effects an adjustment of the support element,

and wherein the loading associated with the structure activates the braking means if the moveability of a surface contact portion of the support element is reduced below a threshold value.

40. A support as claimed in claim 39 which is otherwise as defined in any one of claims 1 to 24.

DATED this 23rd March 2005

ANTONY LAWRENCE PIKE

By his Patent Attorneys

GRIFFITH HACK

2005901474 24 Mar 2005

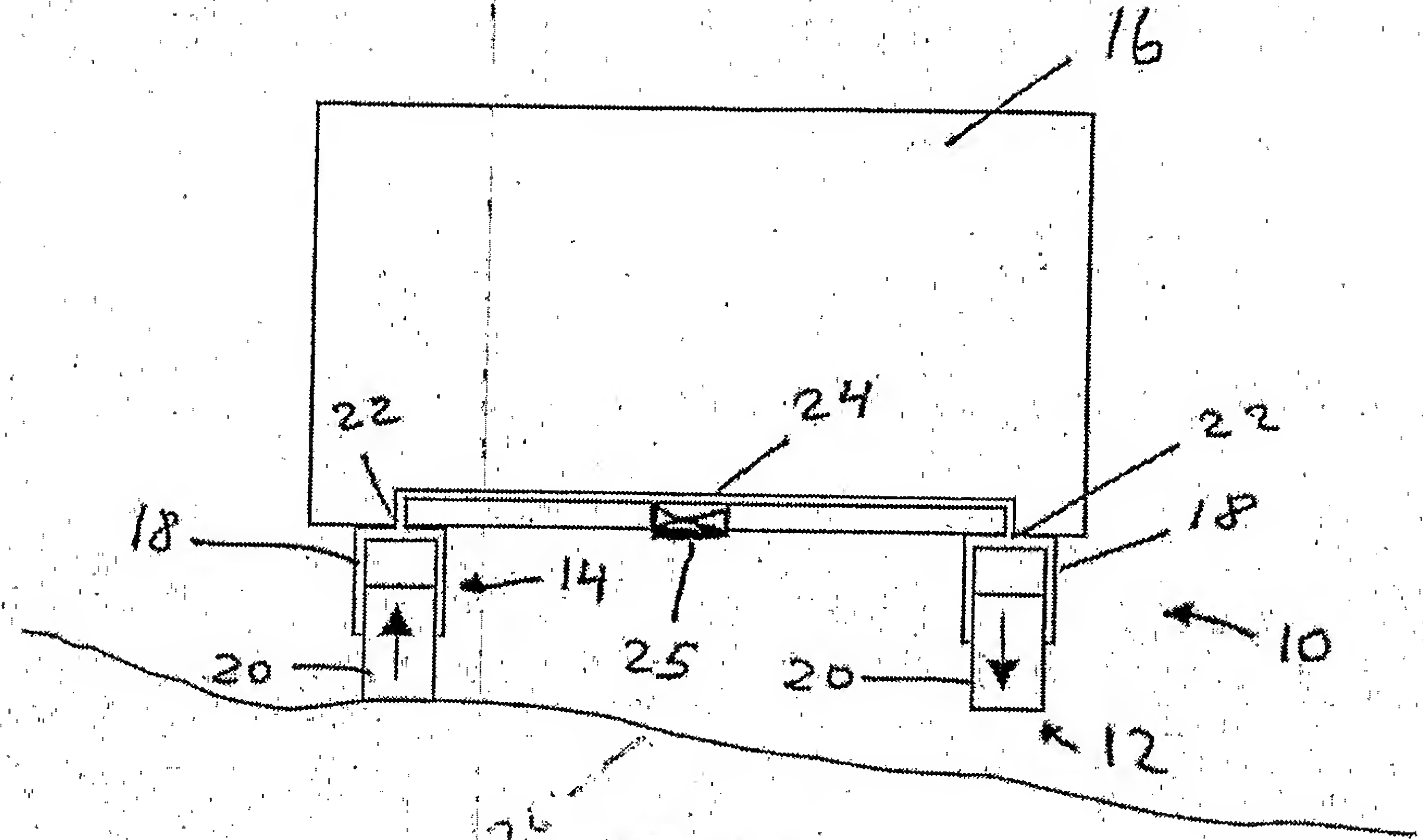


*Fig. 1A*

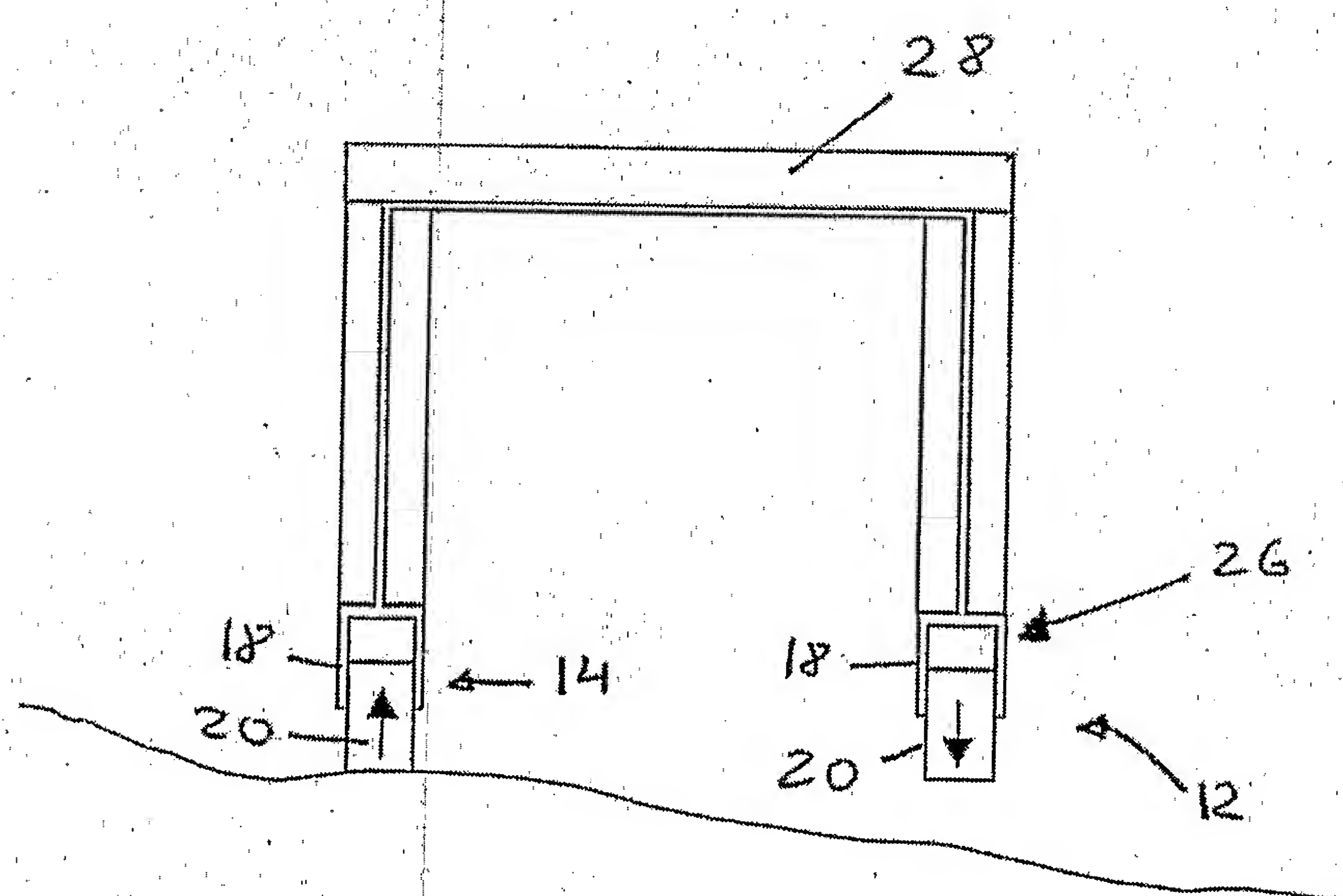


*Fig. 1B*

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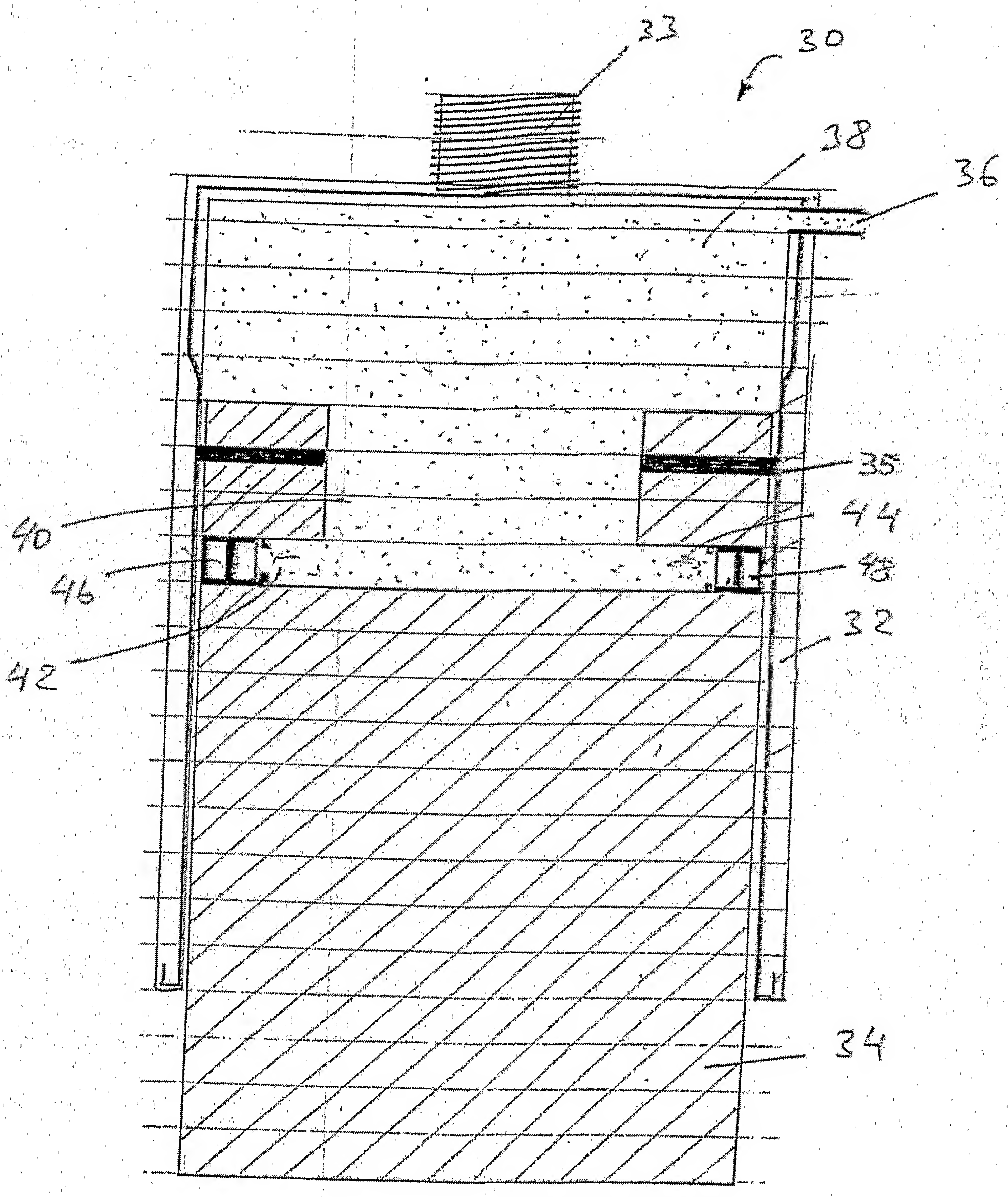


FIG. 2

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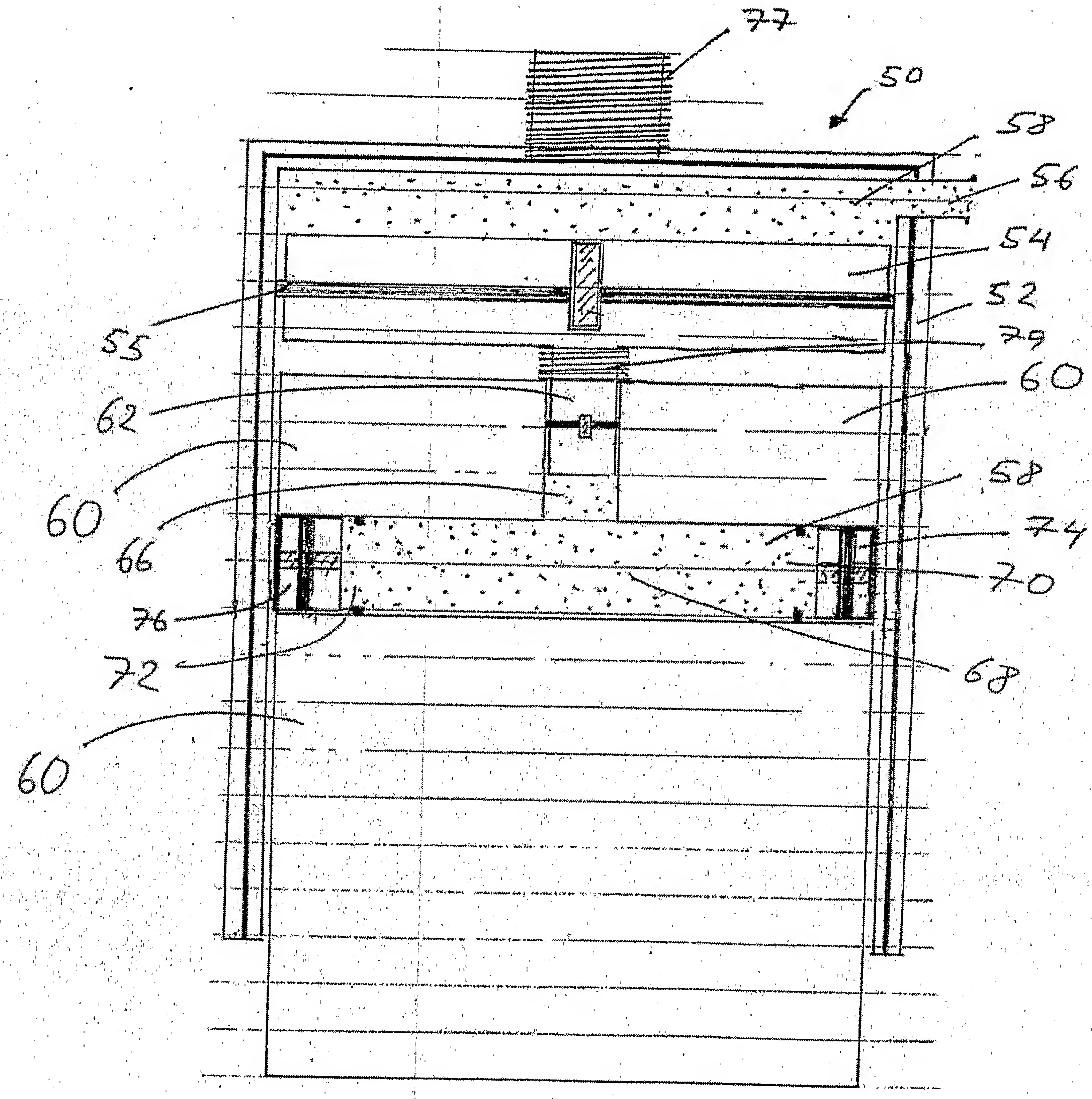


FIG. 3

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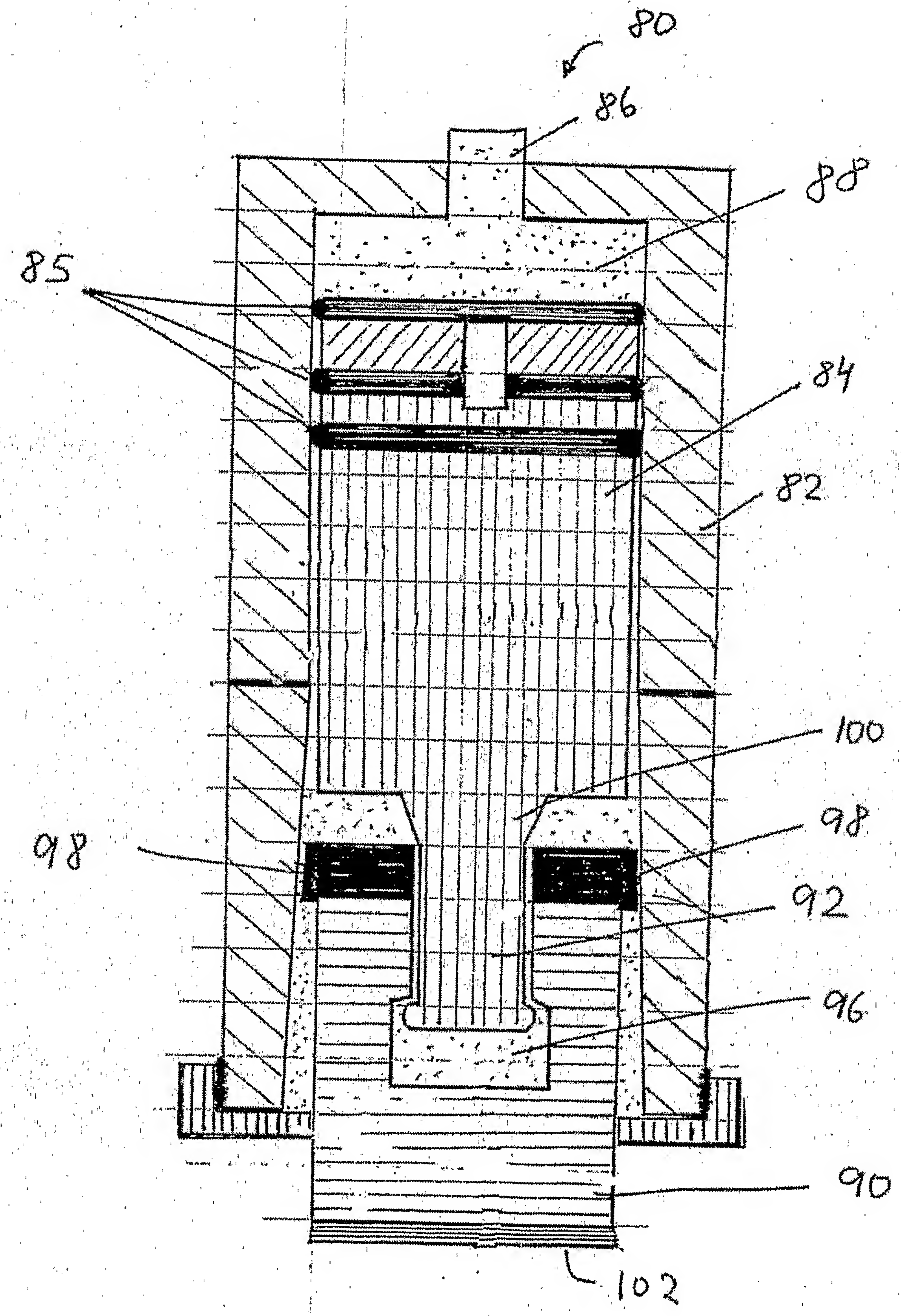


FIG. 4

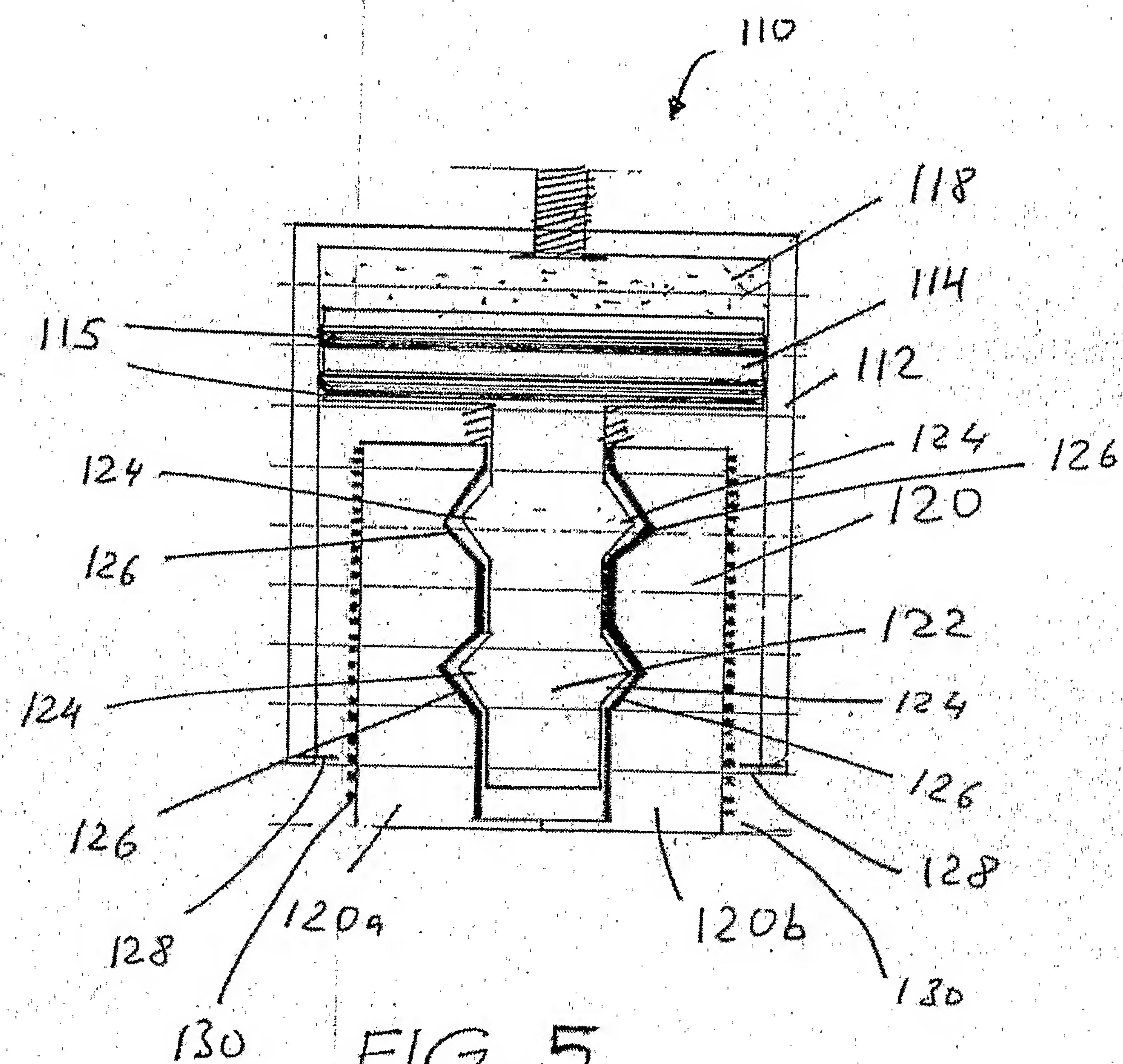


FIG. 5

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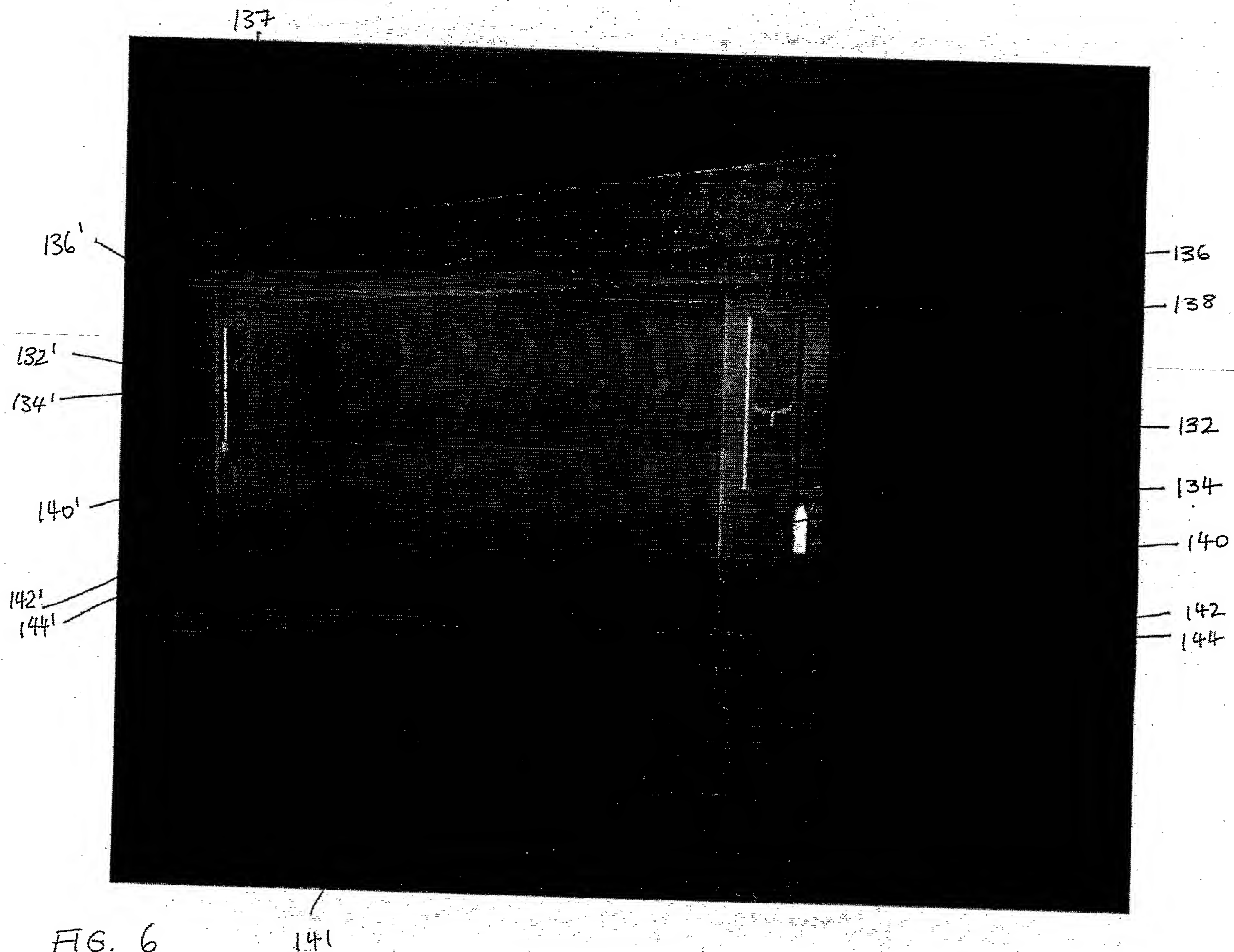


FIG. 6

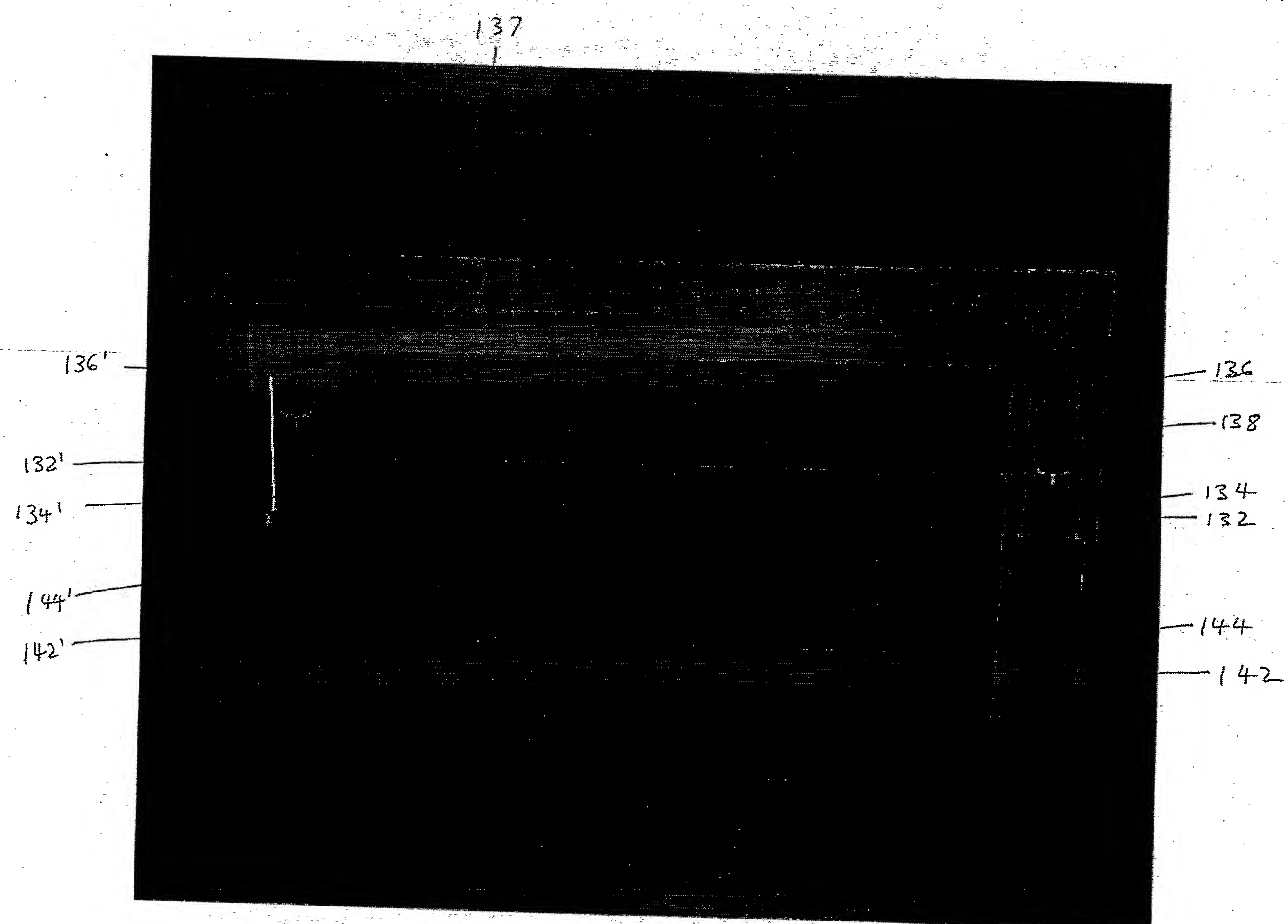


FIG. 7

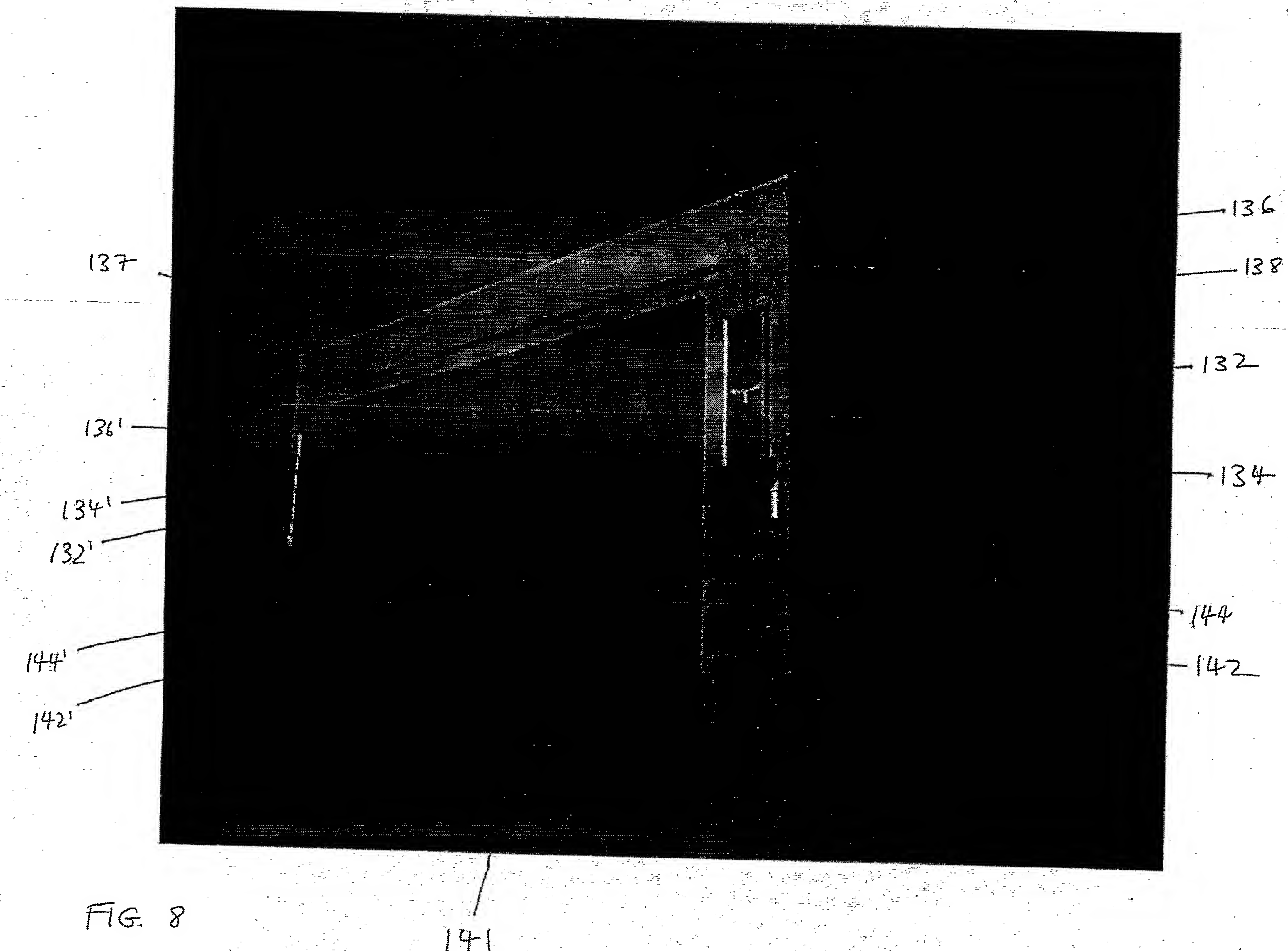


FIG. 8

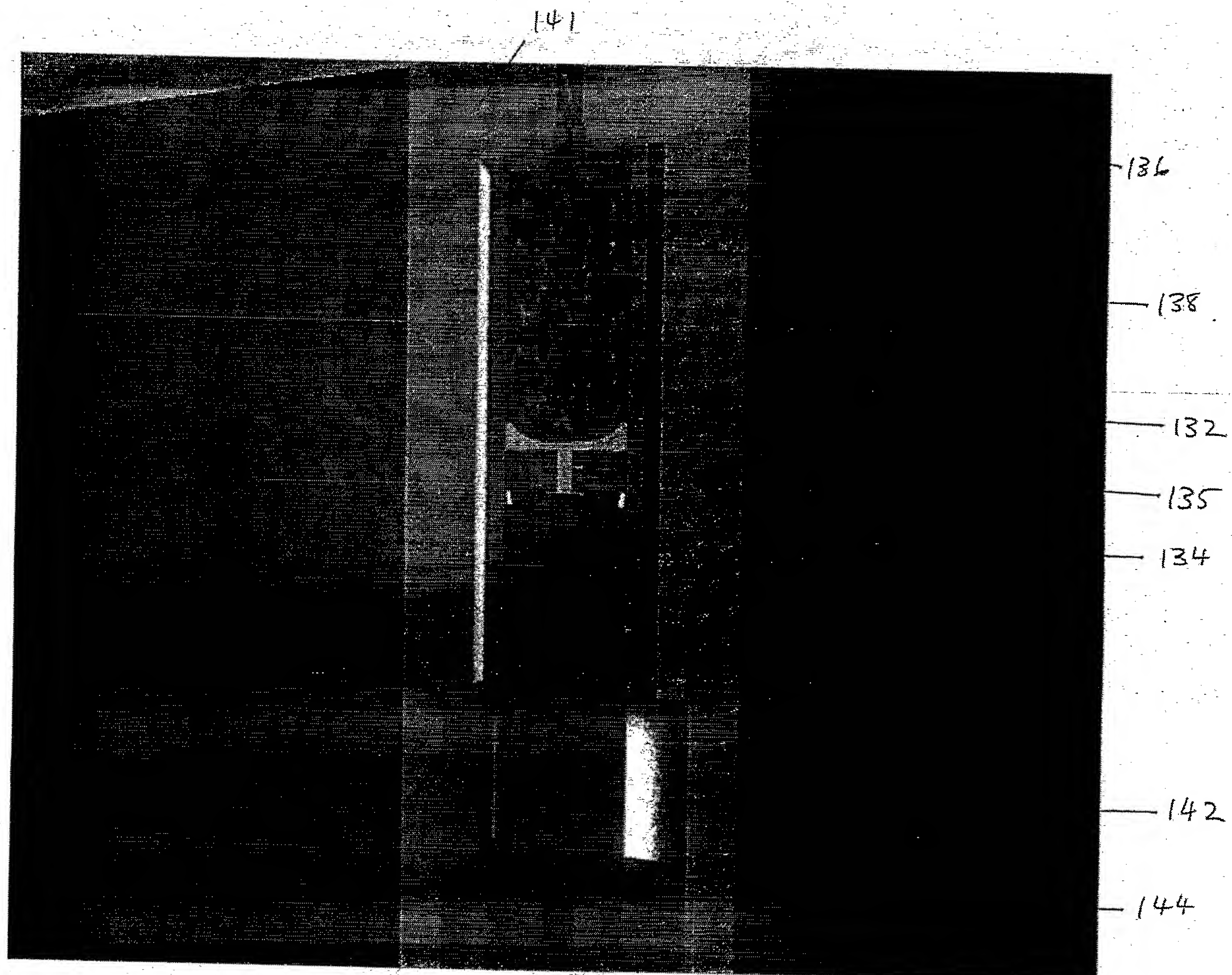


FIG. 9

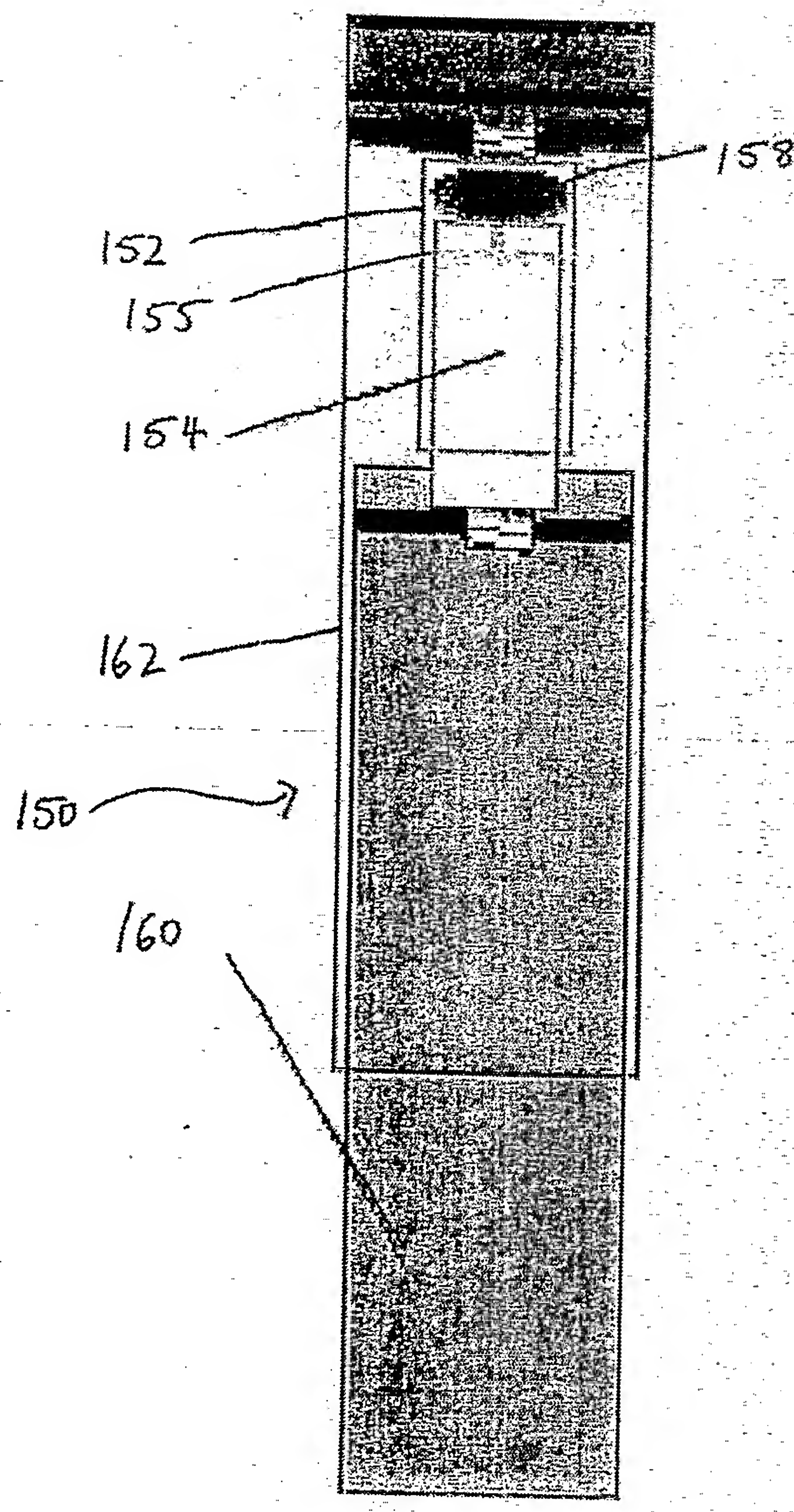


Fig. 10A

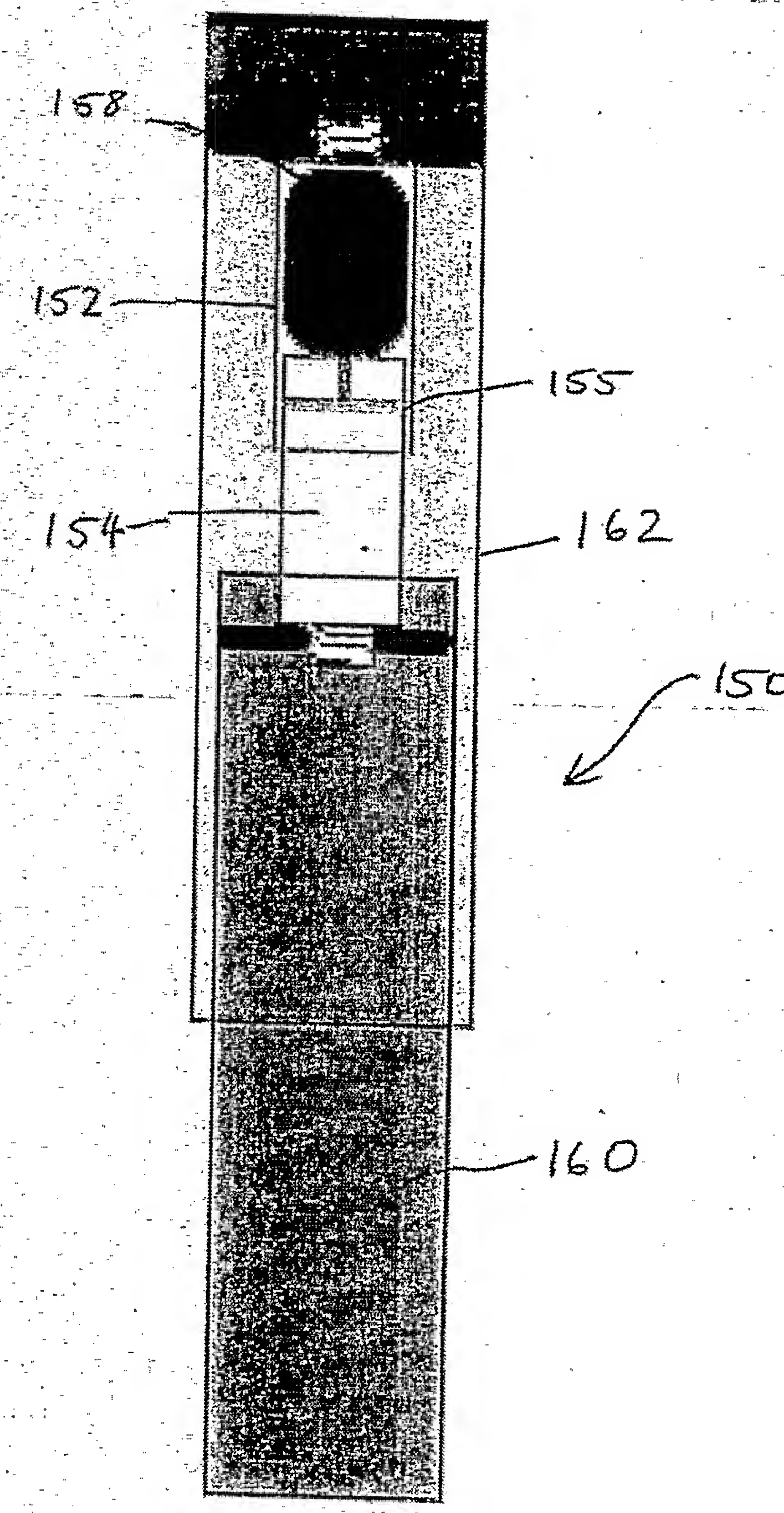


Fig 10B

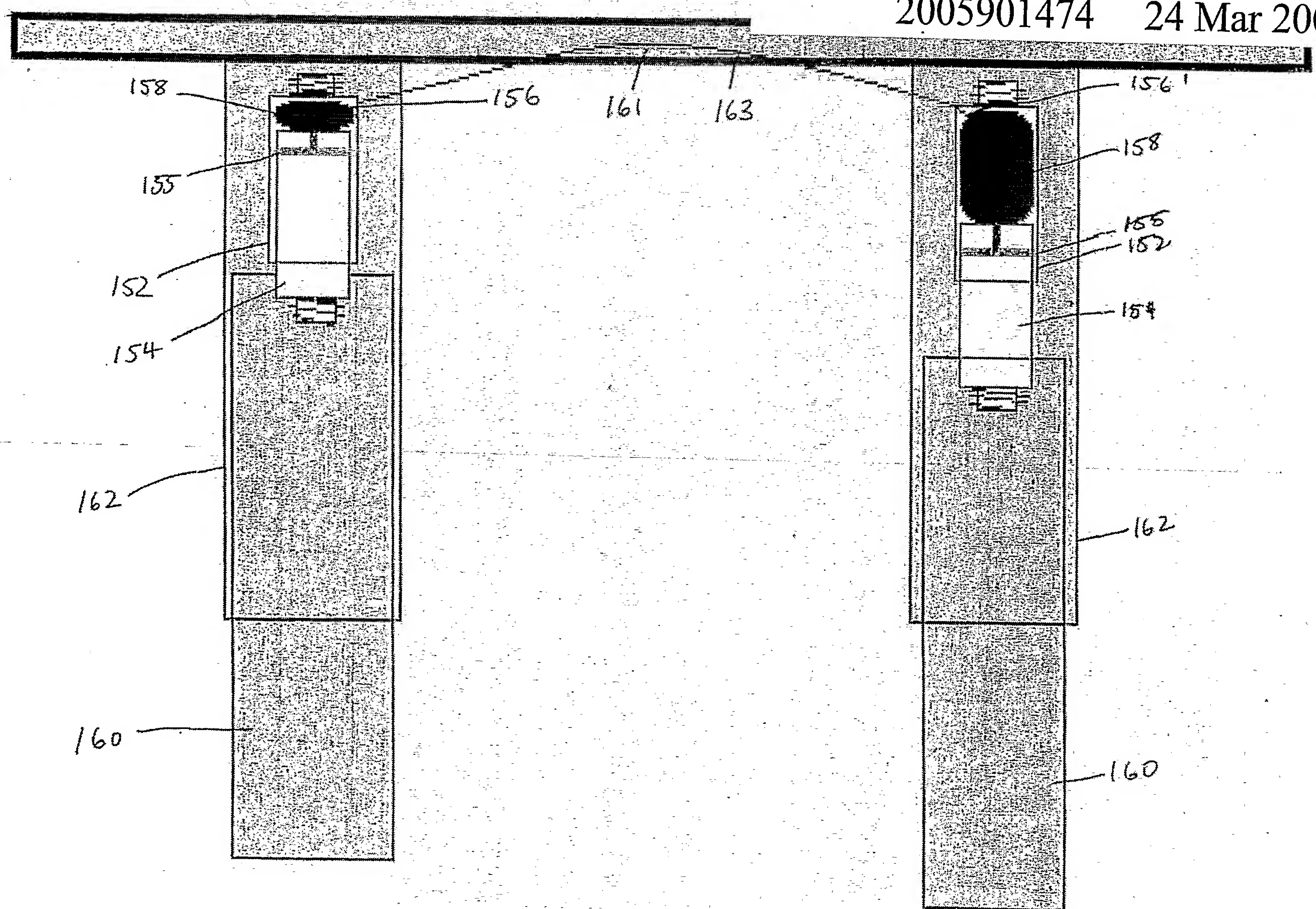


Fig. 11

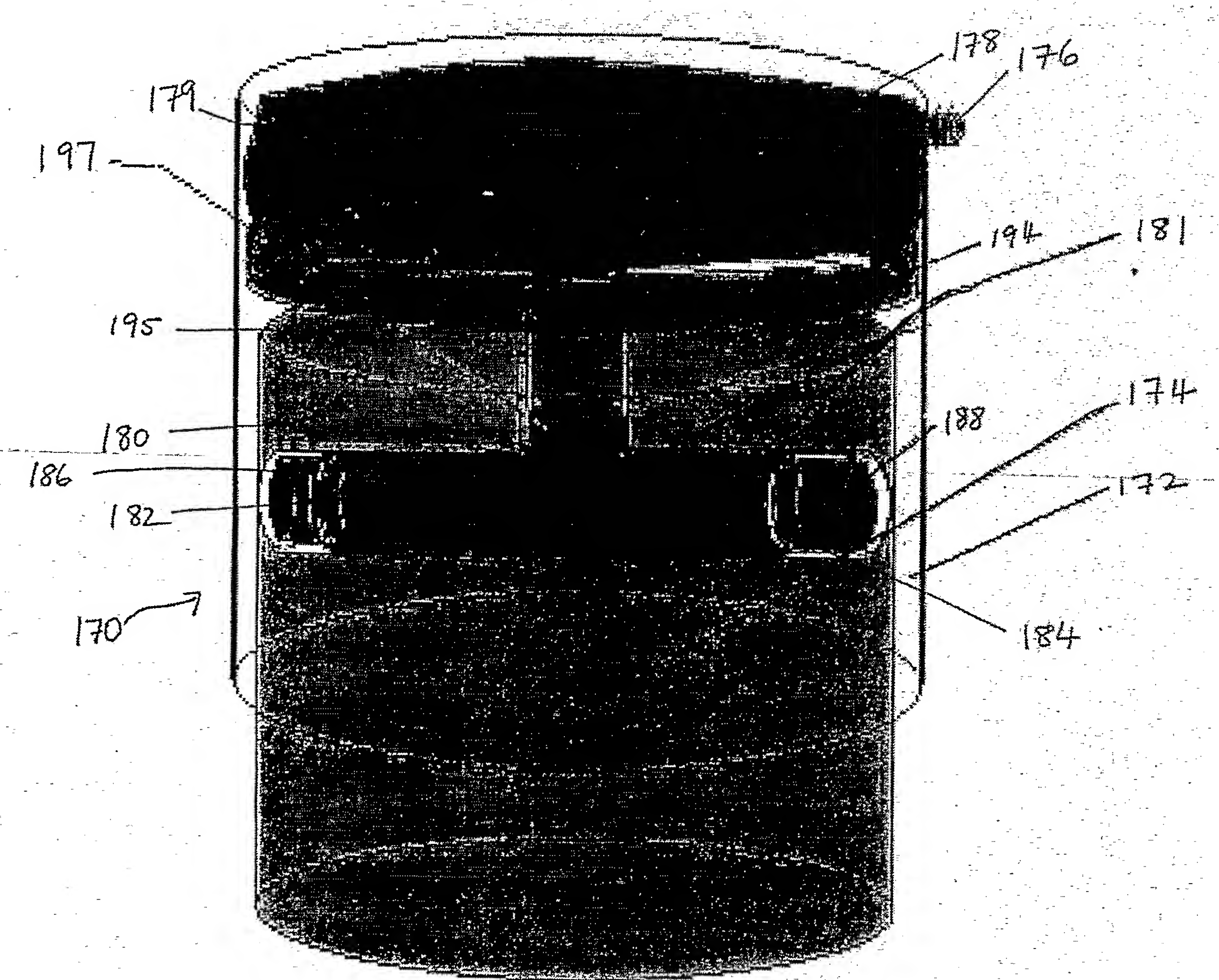


Fig 12

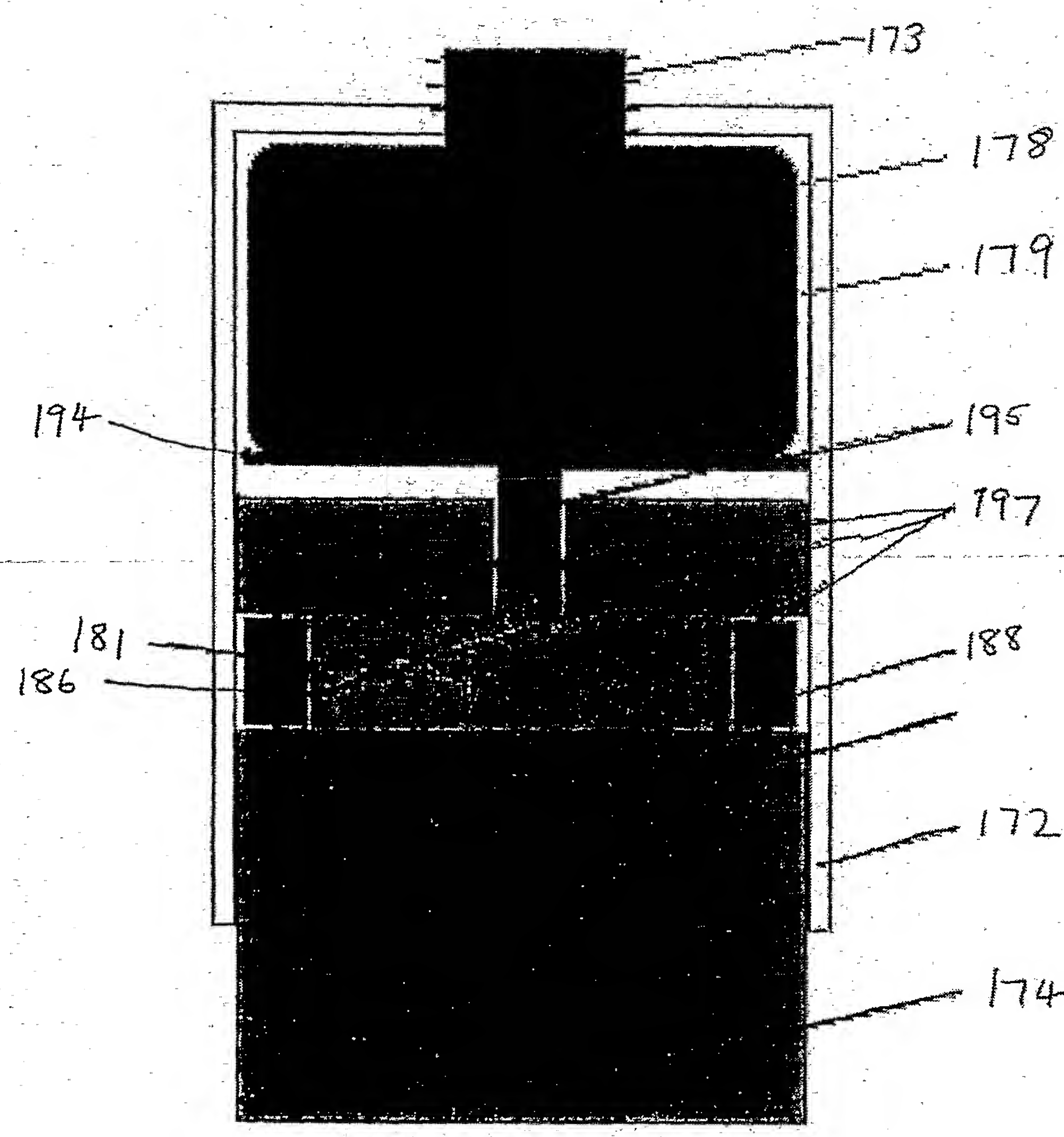


Fig. 13

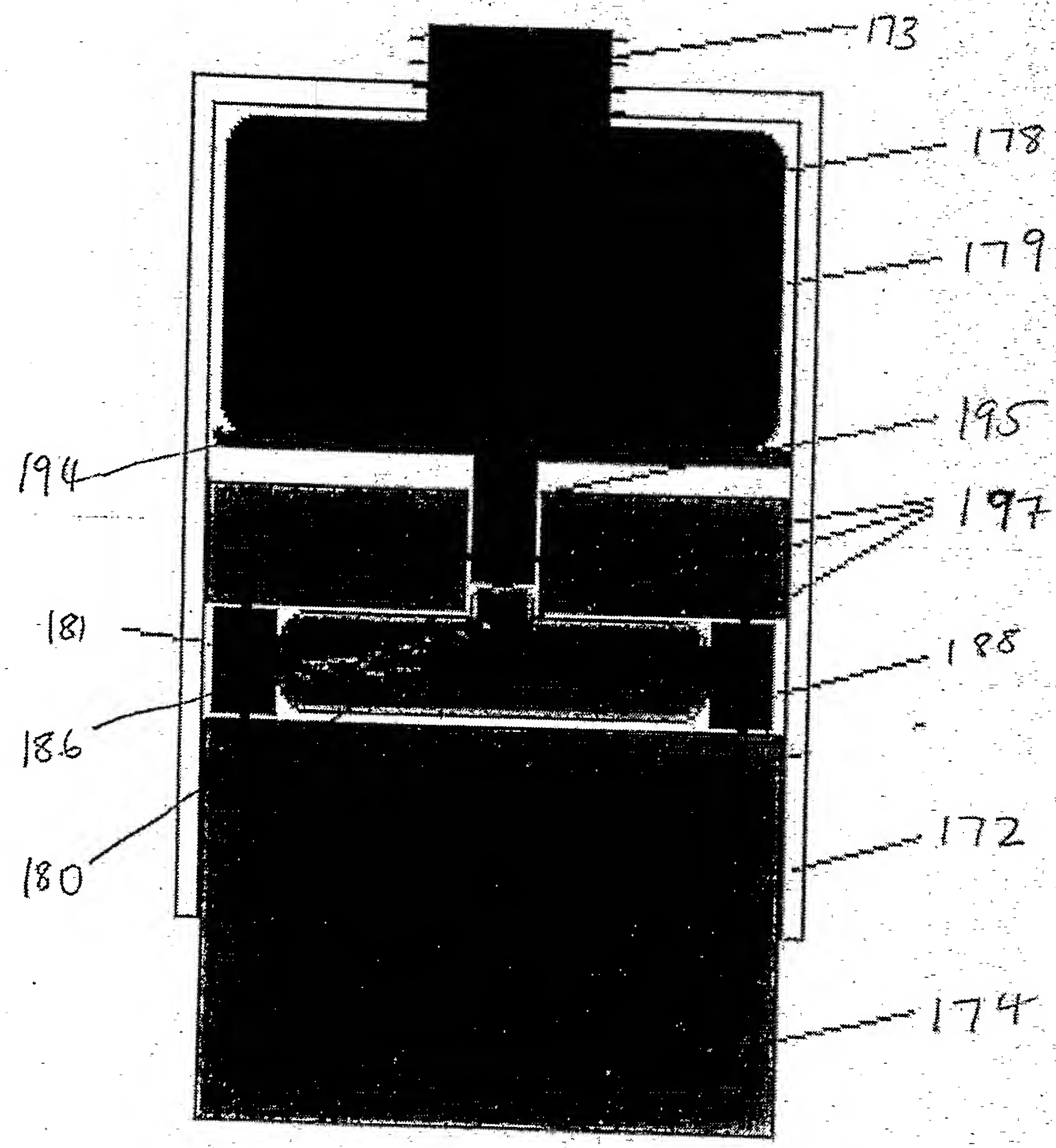


Fig 14

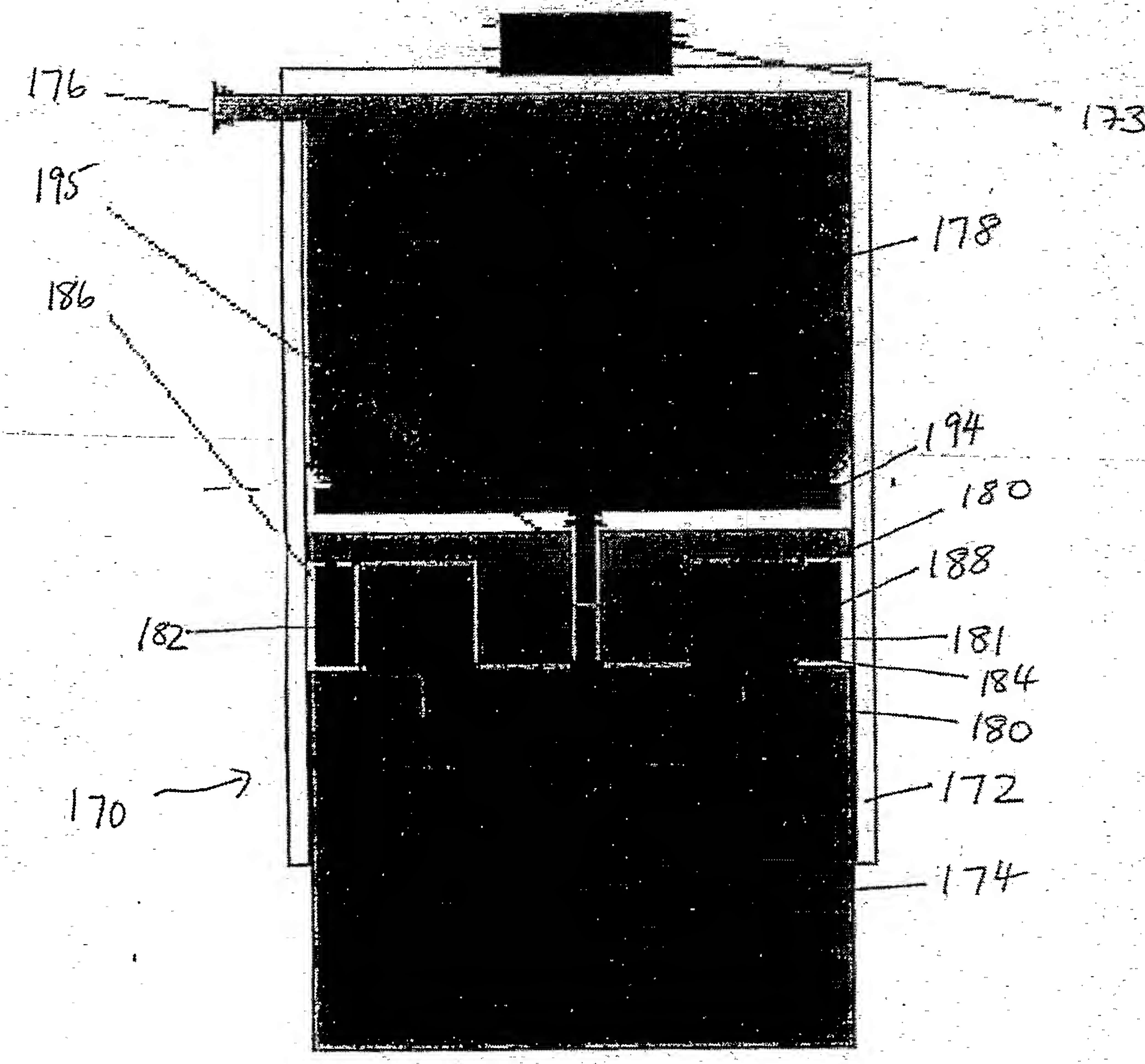


Fig. 15

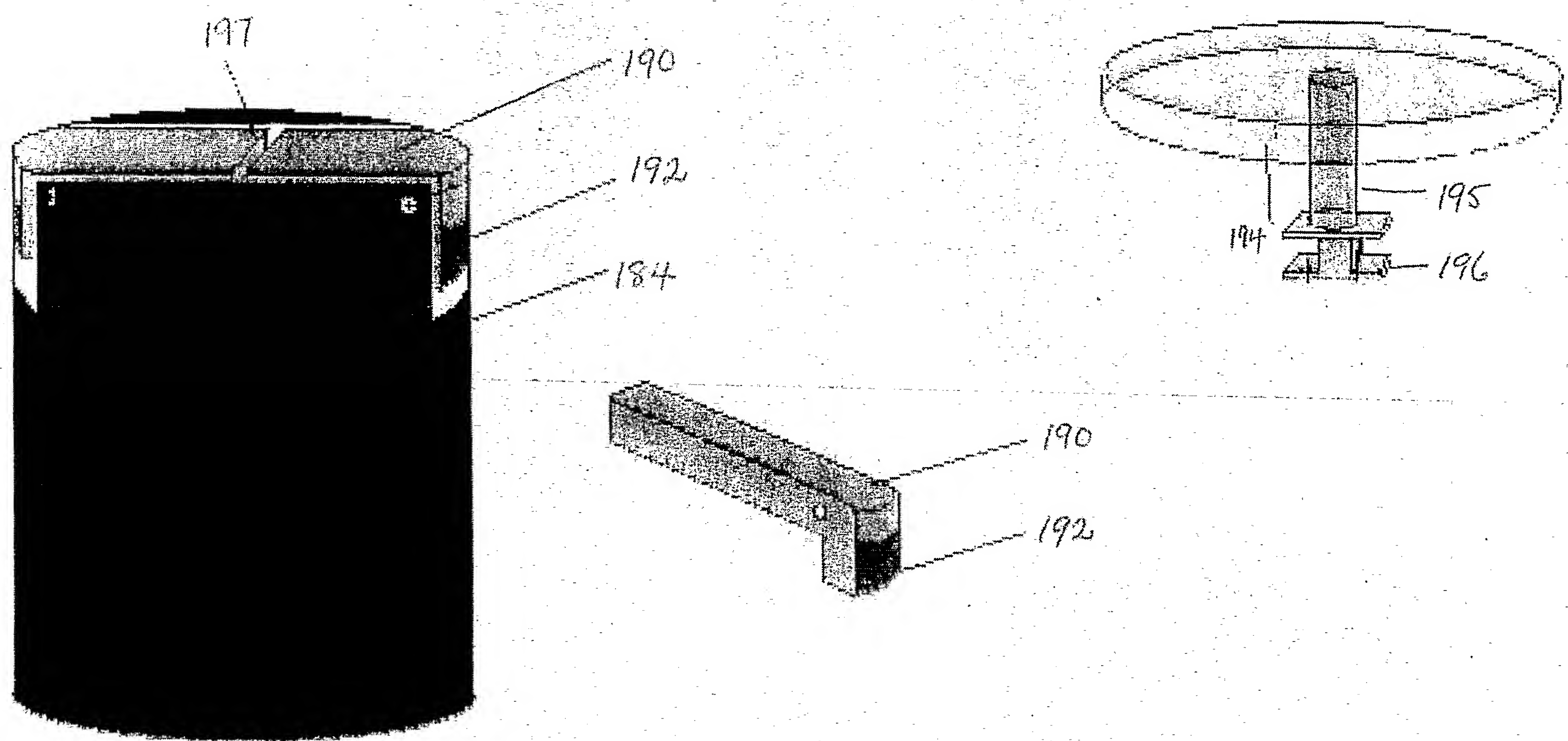


FIG. 16

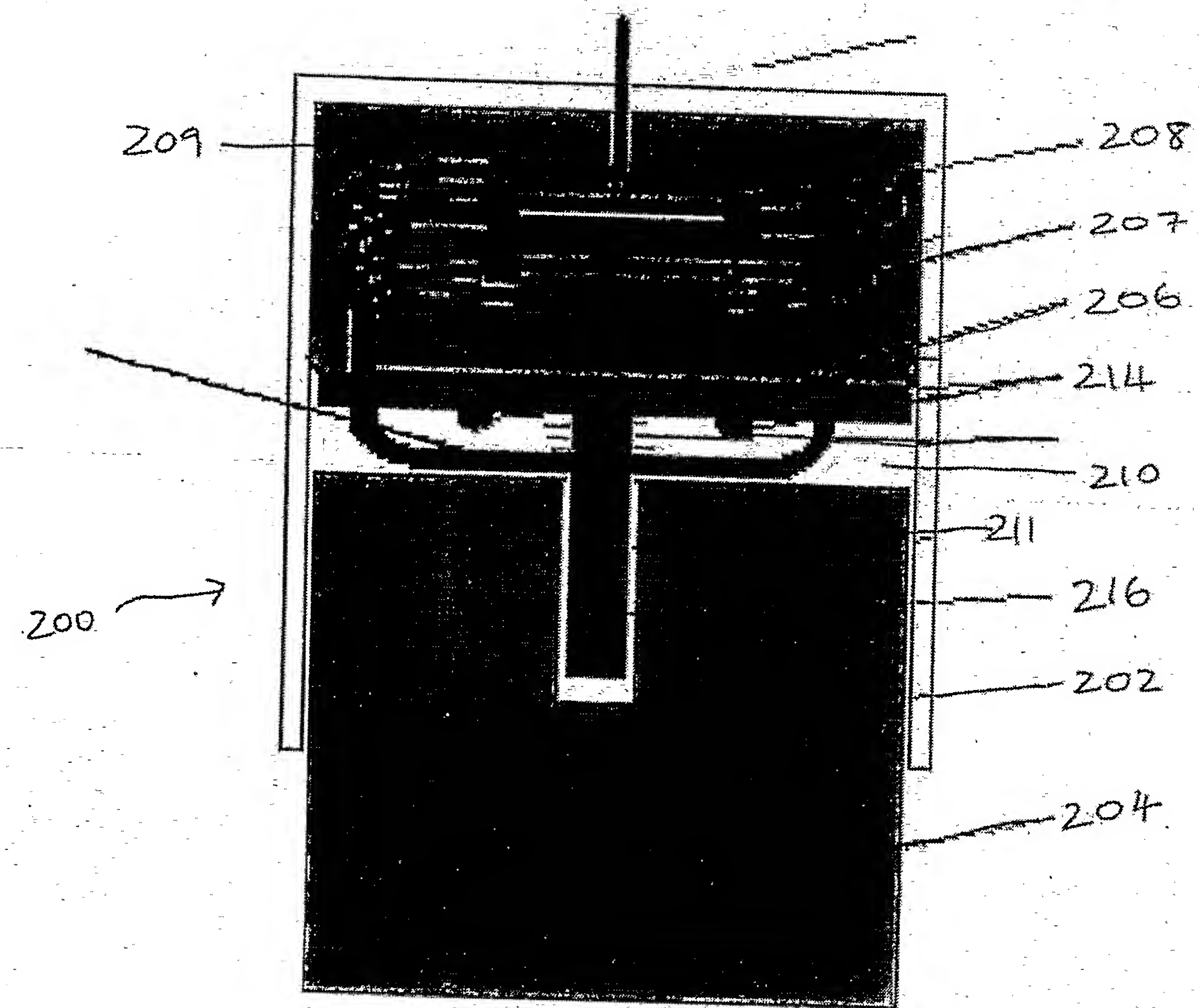


Fig. 17

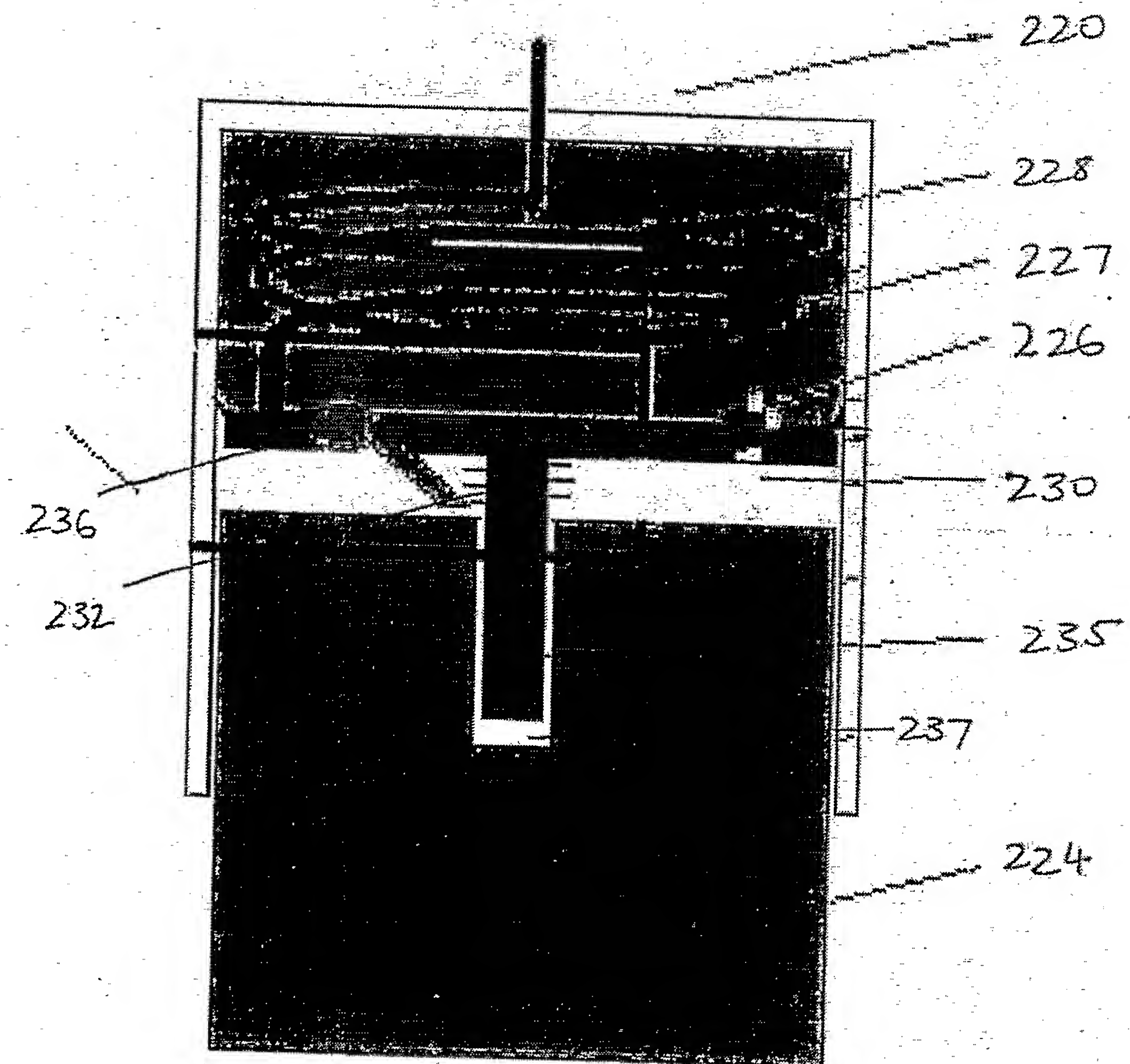


Fig 18

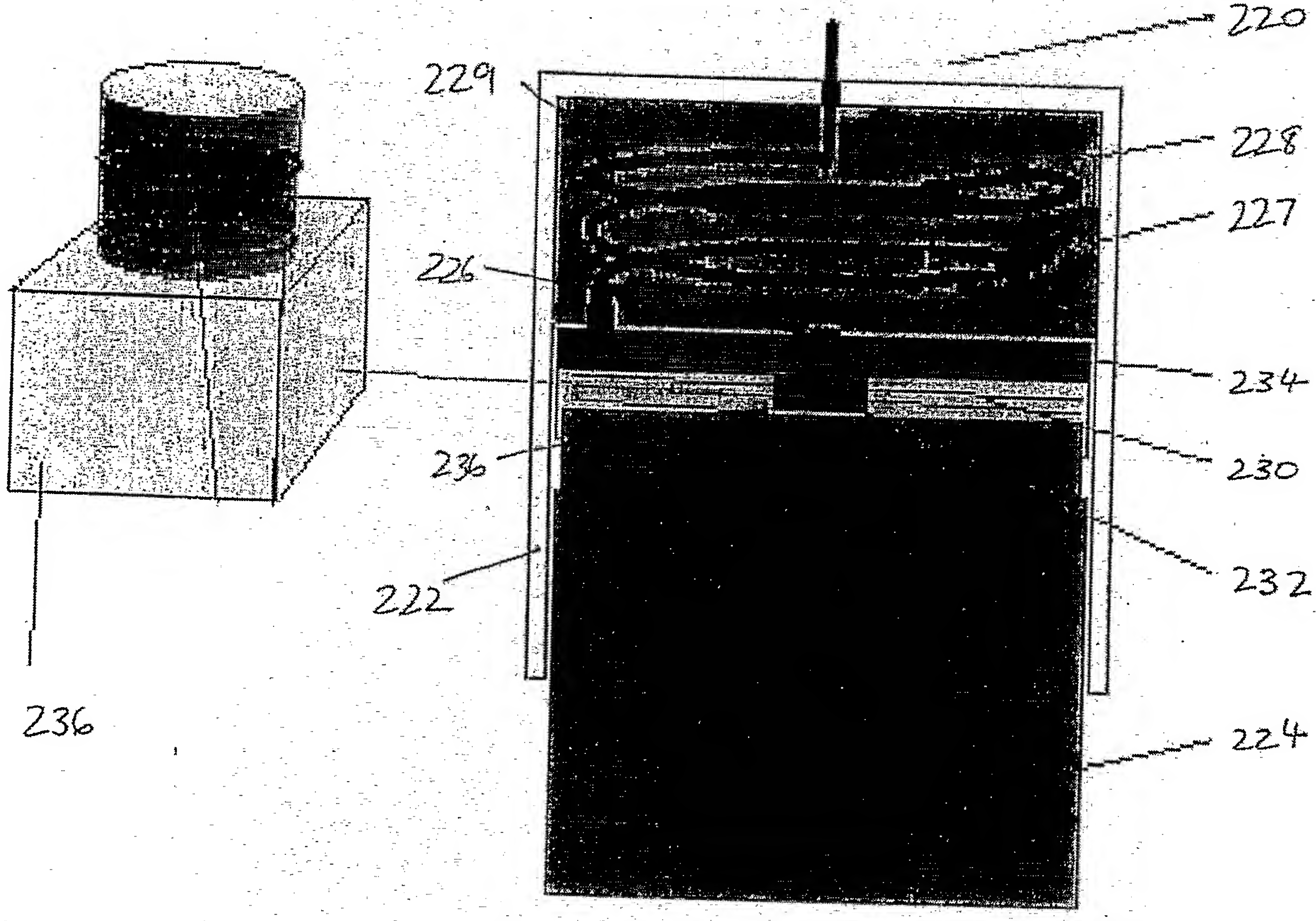


Fig 19

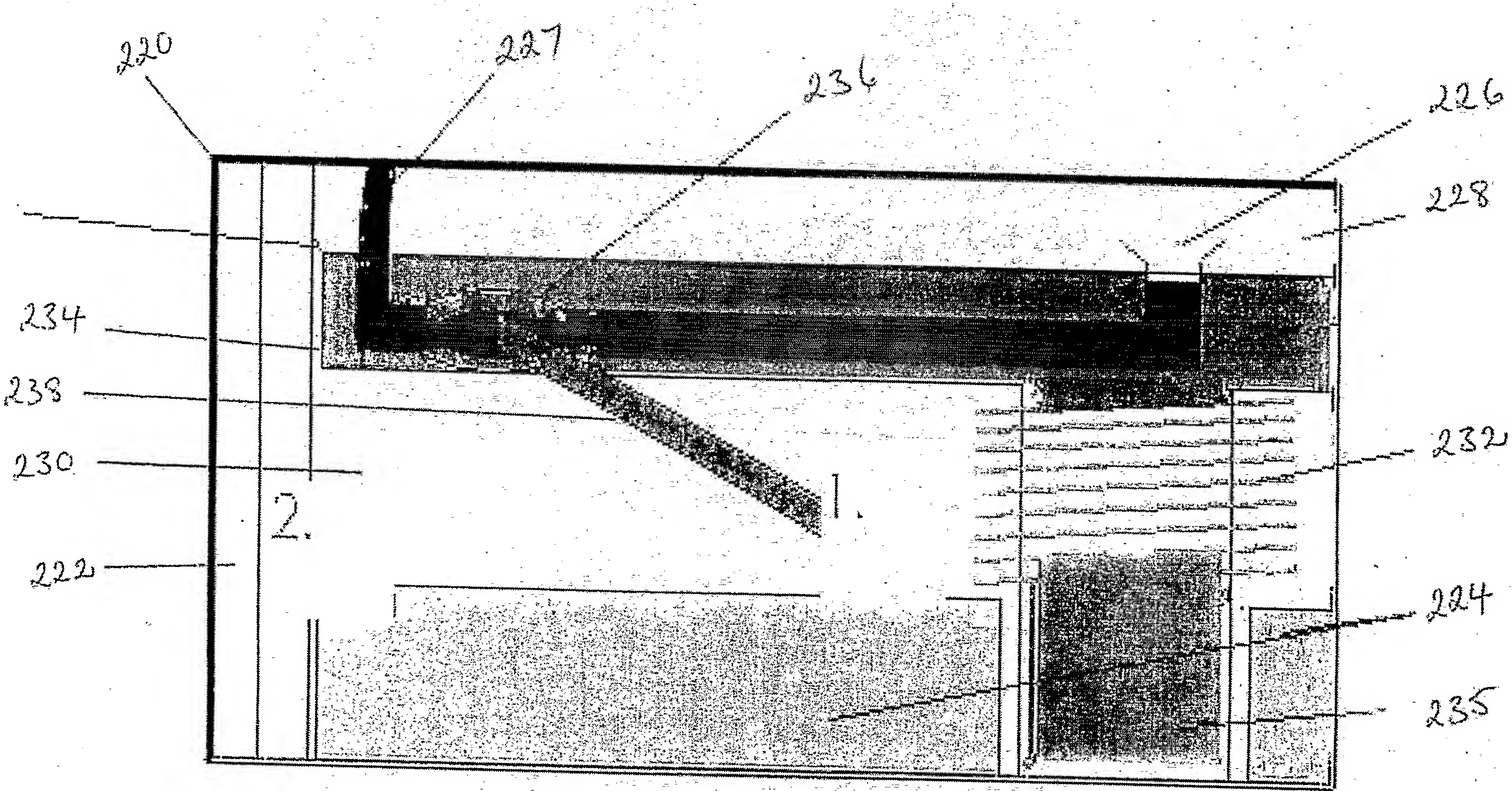


FIG. 20

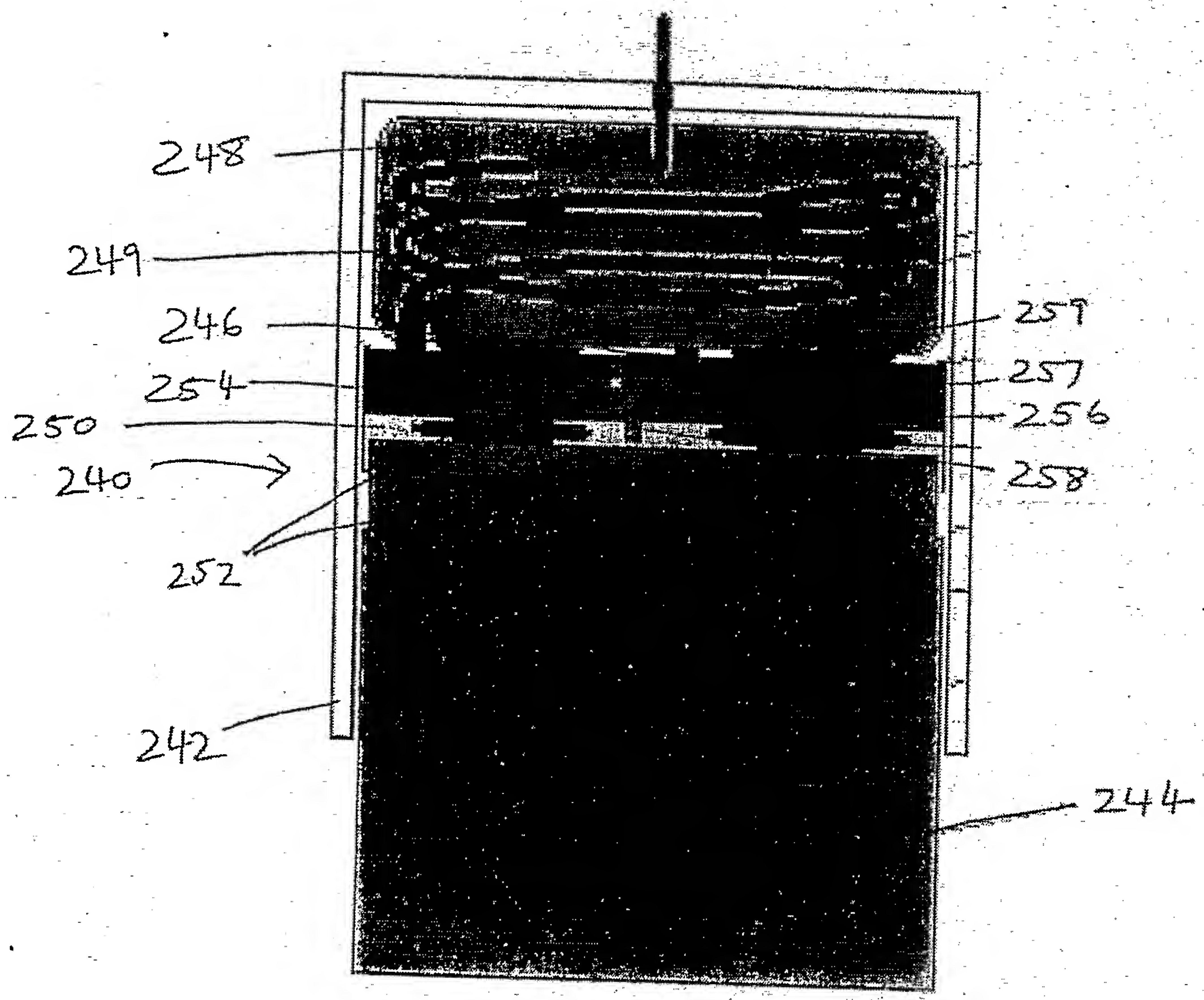


Fig. 21

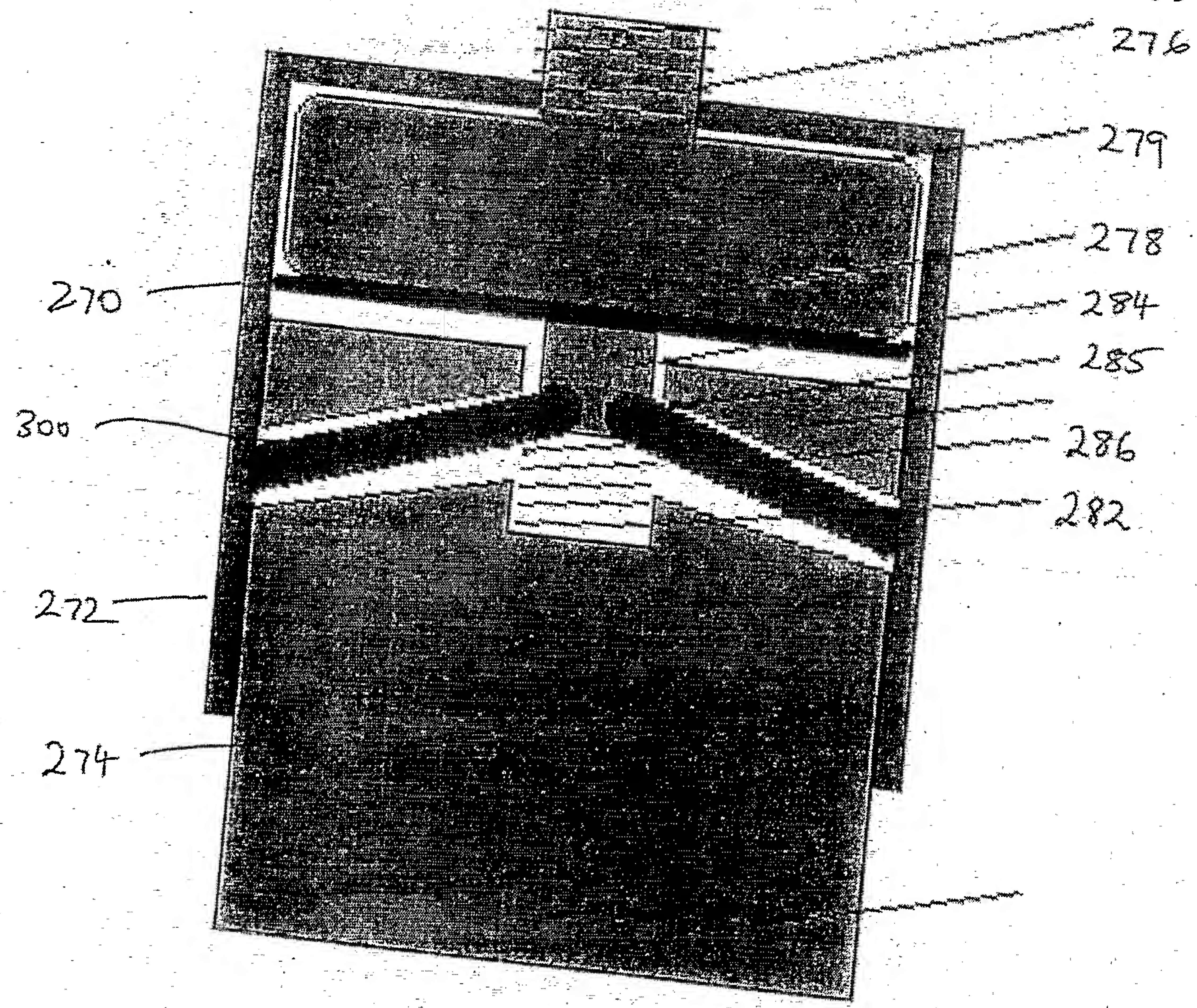


FIG. 22

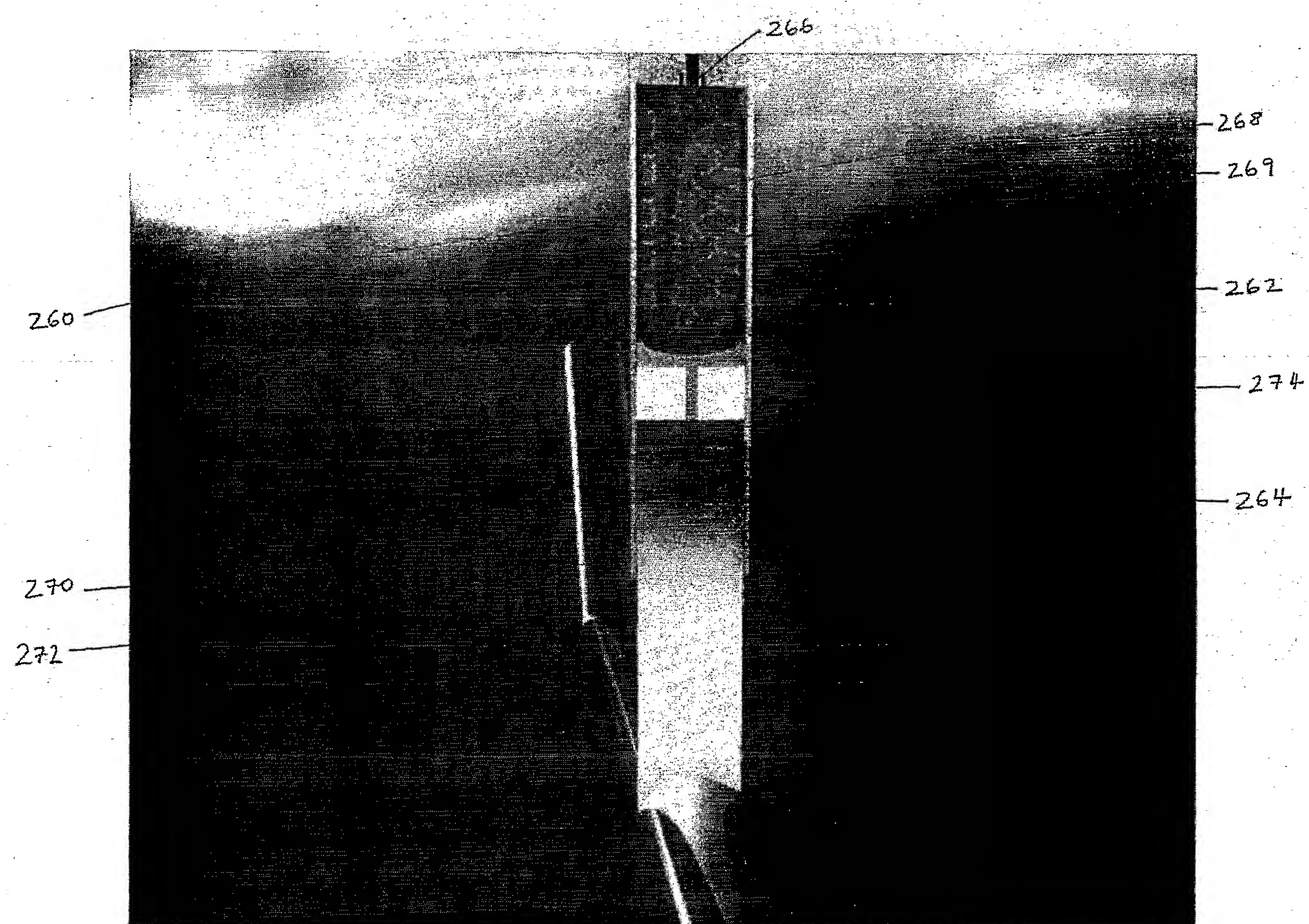


FIG 23

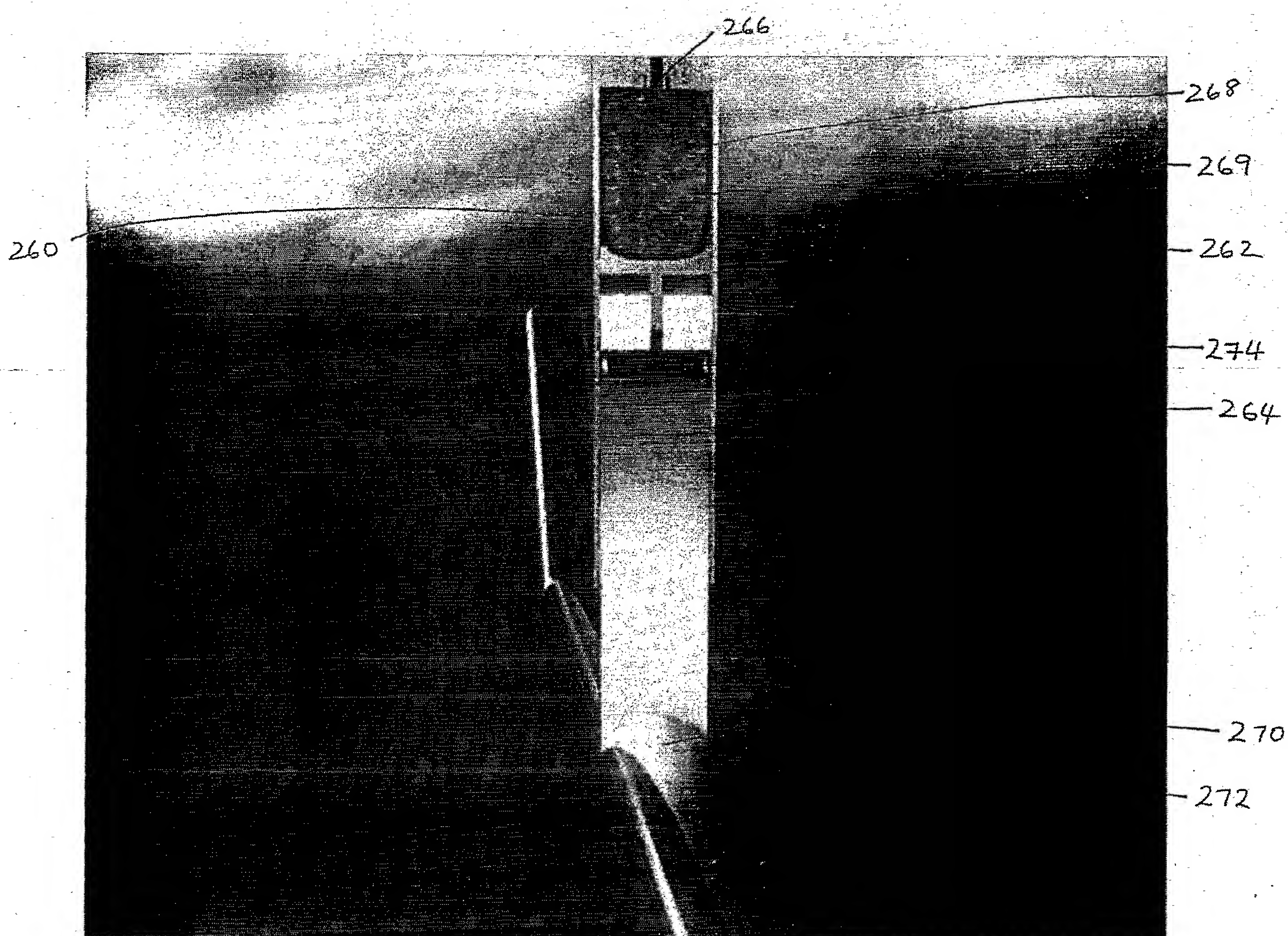


FIG 24